Q
11
F6F63
I
NH

ISSN: 0098-4590

Florida Scientist

Volume 51 Winter 1988 Number 1

SMITHSONIAN
JUN 1 3 1988
LIBRARIES

SMITHSONIAN
JUN 1 3 1988

CONTENTS

Spawning Season of Common Snook Along the East Central Florida Coast . . . . John W. Tucker, Jr. and Silas W. Campbell 1
The Yeast Community Associated with Decaying *Opuntia Stricta* (Haworth) in Florida with Regard to the Moth *Cactoblastic Cactorum* (Berg) . . . . William T. Starmer, Virginia Aberdeen and Marc-Andre LaChance 7
Osteology of the Prehistoric Boynton Beach Indians . . . . M. Yaşar İşcan and Morton H. Kessel 12
Denisty and Dispersion Estimates for Sea Urchins in a South Florida Seagrass Community . . . . Jeremy R. Montague, L. Ortiz, Alexandra Arguelles, Justina M. Millan, and Lynette Cardoch 19
Hermaphroditism in the Asteroid *Luidia Clathrata* (Say) . . . . Paula F. Dehn 23
Social Factors, Health Knowledge, and Health Attitudes: Participation in a Cardiovascular Risk Reversal Program . . . . Curtis W. Wienker and Travis J. Northcutt, Jr. 28
Adoption-Related Counseling Services in the Tampa Bay Area: A Needs Assessment . . . . Marie-Anne G. Johnson 35
Vitamin C and Dental Healing . . . . Robert A. Halberstein and Glenn M. Abrahmsohn 41
Water Quality Characteristics of a Southeast Florida Sewage Treatment and Bioeffects Laboratory . . . . Eugene F. Corcoran, Melvin S. Brown, and Samuel C. Snedaker 49
Review 55
The Ethnography of an Extended Care Treatment Residence for Homeless Men Who Are Chronic Alcoholics . . . . Lois Bright Randolph 56
Review . . . . Richard P. Wunderlin 62
Review . . . . Patricia M. Dooris 63

QUARTERLY JOURNAL OF THE FLORIDA ACADEMY OF SCIENCES

FLORIDA SCIENTIST

Quarterly Journal of the Florida Academy of Sciences
Copyright © by the Florida Academy of Sciences, Inc. 1988

Editor: Dr. Dean F. Martin Co-Editor: Mrs. Barbara B. Martin
Chemical and Environmental Management Services (CHEMS) Center
Department of Chemistry
University of South Florida
Tampa, Florida 33620

The Florida Scientist is published quarterly by the Florida Academy of Sciences, Inc., a non-profit scientific and educational association. Membership is open to individuals or institutions interested in supporting science in its broadest sense. Applications may be obtained from the Executive Secretary. Both individual and institutional members receive a subscription to the Florida Scientist. Direct subscription is available at $20.00 per calendar year.

Original articles containing new knowledge, or new interpretation of knowledge, are welcomed in any field of Science as represented by the sections of the Academy, viz., Biological Sciences, Conservation, Earth and Planetary Sciences, Medical Sciences, Physical Sciences, Science Teaching, and Social Sciences. Also, contributions will be considered which present new applications of scientific knowledge to practical problems within fields of interest to the Academy. Articles must not duplicate in any substantial way material that is published elsewhere. Contributions are accepted only from members of the Academy and so papers submitted by non-members will be accepted only after the authors join the Academy. Instructions for preparation of manuscripts are inside the back cover.

Officers for 1987-88
FLORIDA ACADEMY OF SCIENCES
Founded 1936

President: Dr. Leslie Sue Lieberman
Department of Anthropology
University of Florida
Gainesville, Florida 32611

President-Elect: Dr. Marvin L. Ivey
Department of Natural Sciences
St. Petersburg Junior College
P.O. Box 13489
St. Petersburg, FL 33733

Secretary: Dr. Patrick J. Gleason
1131 North Palmway
Lake Worth, Florida 33460

Treasurer: Dr. Anthony F. Walsh
5636 Satel Drive
Orlando, Florida 32810

Executive Secretary:
Dr. Alexander Dickison
Department of Physical Sciences
Seminole Community College
Sanford, FL 32771

Program Chairs: Dr. George M. Dooris
Dr. Patricia M. Dooris
P.O. Box 2378
St. Leo, Florida 33574

Published by the Florida Academy of Sciences, Inc.
810 East Rollins Street
Orlando, Florida 32803

Printed by the Storter Printing Company
Gainesville, Florida 32602

Florida Scientist

QUARTERLY JOURNAL OF THE FLORIDA ACADEMY OF SCIENCES

DEAN F. MARTIN, *Editor* BARBARA B. MARTIN, *Co-Editor*

Volume 51 Winter 1988 Number 1

Biological Sciences

SPAWNING SEASON OF COMMON SNOOK ALONG THE EAST CENTRAL FLORIDA COAST

JOHN W. TUCKER, JR. AND SILAS W. CAMPBELL

Harbor Branch Oceanographic Institution, 5600 Old Dixie Highway, Fort Pierce, Florida 33450

ABSTRACT: *Reproductive activity in common snook* (Centropomus undecimalis) *was investigated by examining 57 male and 83 female specimens collected near Fort Pierce, Florida during 1984-85. From late April to early October, yolked eggs were present and spawning could have occurred. From mid-April to mid-September, mean oocyte diameter was in the range 313-419 μm, mean female gonadosomatic index was 2.0-5.0%, and male GSI was 0.8-2.0%.*

THE common snook *(Centropomus undecimalis)*, a member of the tropical fish family Centropomidae, is found from Rio de Janeiro, Brazil to Pamlico Sound, North Carolina, but is rare north of Florida (Rivas, 1986). Intolerance to low winter temperatures restricts its normal northern range to southern Texas and central Florida (Tampa and Cape Canaveral).

The common snook is a coastal species that spends much of its life in estuaries or freshwater tributaries (especially as juveniles), but migrates to ocean inlets or just offshore to spawn. The biology of common snook in southwest Florida was investigated by Marshall (1958), Volpe (1959), and Fore and Schmidt (1973). Lau and Shafland (1982) described larval development and Gilmore and co-workers (1983) examined juvenile populations in east central Florida.

In Florida, snook are at the normal limits of their distribution and are likely to be more vulnerable to environmental stress and fishing pressure. Because some Florida populations have declined in recent years (Gerard Bruger, Florida Department of Natural Resources, pers. comm., March 1987), the common snook is currently designated a "species of special concern" by the state government. Information on reproduction is essential for effective management. This paper documents the season of reproductive activity in the Fort Pierce area.

MATERIALS AND METHODS—Common snook were collected by hook and line from the east (Fort Pierce Inlet) and west (Turning Basin) ends of the Fort Pierce Channel and from the Atlantic Ocean 1 km off South Hutchinson Island 14 km south of Fort Pierce Inlet. Total weight and fork length were measured and gonadosomatic index (GSI) was calculated as percent fresh gonad weight of total weight. Gonads were fixed in Holland's Fixative (1984) or 10% buffered formalin (1985) and preserved in 70% ethanol. Ovaries were embedded in paraffin, transversely sectioned at 10μm, and stained with Delafield hematoxylin and eosin. Staging of oocytes follows Hunter and Macewicz (1985), including: unyolked, partially yolked (early vitellogenesis), yolked (yolk globules present in entire region between the outer edge of the oocyte and the nucleus), hydrated (nuclear membrane disintegrated, yolk fused into plates), ovulated, and alpha stage atresia (yolked oocyte resorption). The length and width of the largest 10 oocytes in each section were measured and a mean diameter was calculated. Because oocyte stages and mean diameters in histological sections taken from both ends and the middle of ovaries from four specimens did not differ, the remaining specimens were sectioned only through the middle. Throughout the study, surface ocean water temperatures adjacent to Fort Pierce Inlet were measured.

RESULTS AND DISCUSSION—During 1984, about 200 common snook specimens were caught, examined, and released. Gonads were removed from 40 mature males and 57 mature females. Male weights were 0.7-8.2 kg (mean 4.0 kg); fork lengths were 397-908 mm (mean 690 mm). Female weights were 2.3-12.7 kg (mean 6.6 kg); fork lengths were 584-1,052 mm (mean 815 mm). During 1985, gonads were removed from 17 mature males and 28 mature females. Male weights were 1.4-7.3 kg (mean 4.7 kg); fork lengths were 495-850 mm (mean 739 mm). Female weights were 2.4-12.7 kg (mean 6.4 kg); fork lengths were 584-978 mm (mean 792 mm).

Oocyte and GSI data are grouped at monthly intervals, from the 16th to the 15th (Table 1). In 1984, oocytes were mostly large and yolked from early May until early October, when GSI decreased and oocytes became smaller. One atretic specimen was caught at Fort Pierce Inlet on October 4. Specimens capable of spawning were caught during May 6-October 7. In 1985, oocytes were mostly large and yolked from early May until early August or later. By early October, GSI decreased and oocytes became smaller. One hydrated specimen was caught at Fort Pierce Inlet at 1630 EST on July 29. One atretic specimen was caught at Fort Pierce Inlet on October 7. Specimens capable of spawning were collected during April 28-August 3 at Fort Pierce.

In 1984, individual female GSI ranged from 6.7% in early August to 0.2% in early October; average female GSI peaked at 5.0% in July-August and was $\leq$0.7% from late October to early April. Individual male GSI ranged from 3.1% in early August to 0.04% in early October; average male GSI peaked at 2.0% during August-September and was $\leq$0.4% from late September to early April. In 1985, individual female GSI ranged from 6.6% in late May to 0.2% in early October; average female GSI peaked at 4.4% in May-June and dropped to 0.2-0.4% in September-November. Individual male GSI ranged from 2.6% in early July to 0.2% in late July; average male GSI peaked at 1.4% in June-August and dropped to 0.4% in October-November.

Other female snook examined included one caught at Palm Beach Inlet at 1700 EST on September 17 (15.4 kg, 1,118 mm FL) and one caught at Stuart on October 17 (3.6 kg, 720 mm FL). The Palm Beach fish was running ripe and had a GSI of 6.6%; postovulatory follicles were present in histological sections, but no hydrated oocytes. The Stuart fish had a GSI of 1.4% and

TABLE 1. Oocyte stages, oocyte diameters, and gonadosomatic indices from common snook collected near Fort Pierce, Florida, during April 1984 to November 1985 (grouped in one-month intervals from the 16th to the 15th).

	A-M	M-J	J-J	J-A	A-S	S-O	O-N	N-D	D-J	J-F	F-M	M-A	A-M	M-J	J-J	J-A	A-S	S-O	O-N
Unyolked						5	2	1	6		1	2	1						3
Part. yolked		1				2			1										
Yolked	8	7	6	7	2	5							4	4	3	3			
Hydrated																1		a	
Atretic						1												1	
Mean oocyte diameter (μm)	419	376	374	377	360	206	74	64	80		65	86	313	392	363	417		343	66
Standard dev.	21	89	27	19	5	154	3		15			3	134	8	22	68			8
Minimum	393	160	336	351	356	52	72		67			84	77	385	341	360			60
Maximum	453	422	408	398	363	383	77		110			88	393	404	385	410			75
No. of females	8	11	6	8	2	13	2	1	7		1	3	5	4	2	4		1	5
Mean GSI (%)	3.4	3.3	4.2	5.0	2.2	1.0	0.5	0.4	0.6		0.3	0.7	2.0	4.4	2.0	2.2		0.2	0.4
Standard dev.	0.8	1.6	1.3	1.4	0.6	0.8	0.1		0.3			0.0	1.1	1.7	0.2	0.4			0.1
No. of males	4	6	4	8	2	14	2					2	1	4	5	4			1
Mean GSI (%)	0.8	1.1	0.9	1.5	2.0	0.3	0.1					0.4	1.0	1.1	1.4	1.4			0.4
Standard dev.	0.4	0.6	1.0	1.0	0.1	0.4	0.1					0.0		0.8	0.8	0.9			

TABLE 2. Summary of common snook ovary data.

	GSI (%)				Oocyte diameter (μm)			
Oocytes	n	Mean	s.d.	Range	n	Mean	s.d.	Range
Unyolked	21	0.4	0.1	0.2-0.7	21	71	10	52-88
Partly yolked	4	0.5	0.2	0.3-0.8	4	111	36	75-160
Yolked	48	3.3	1.4	1.1-6.7	49	386	27	331-453
Hydrated	1	2.8			1	515		
Ovulated	1	6.6						
Atretic	2	0.7	0.6	0.2-1.1	2	343	0	343-343

yolked oocytes averaging 349 μm in diameter and could have spawned in October.

GSI and oocyte diameter were good predictors of the yolked condition and could be used to separate resting and ripening ovaries (Table 2). Spent fish would require microscopic examination. Sectioned hydrated oocytes were smaller than fresh ovulated eggs (0.5 mm vs 0.7 mm) partly because of shrinkage during histological processing. Ovaries of common snook are group synchronous (Wallace and Selman, 1981), containing up to three or more synchronous groups of oocytes.

In an early study of snook populations in the Thousand Islands area of southwest Florida during one spawning season (beginning in June 1954), Marshall (1958) collected ripe females (with yolked eggs) during June to August and spent females during July to November. He concluded that spawning could occur during May to November but probably was mainly in May to June. Volpe (1959) observed spawning aggregations along the coast of Lee and Collier counties in southwest Florida during June and early July 1956. In early July, he collected two running-ripe females at Captiva Pass. Snook became scarce from mid-July to September, leading to the conclusion that peak spawning was over. The size range of juveniles collected by Fore and Schmidt (1973) in the Ten Thousand Islands area in 1972 indicated possible spawning during May to October. Recent studies in southwest Florida show that most spawning in the Naples and Tampa areas occurs during June to August within a May to October season; spawning at Tampa may be slightly later than at Naples (Gerard Bruger, pers. comm., March 1987). Gilmore et al. (1983) identified two peaks in juvenile snook recruitment in east central Florida (during 1974-1980 seasons) that probably resulted from June-July and August-October spawning peaks. The first recruitment peak was smaller and may have resulted from fewer local spawners or from more distant spawning (i.e., in south or southeast Florida). Major recruitment of 1-2 month old fish occurred in October-November, indicating that the largest local spawning peak was in August-September.

The present study shows that spawning of common snook could have occurred as early as late April and was mostly finished by October. Between 29 September 1984 and 19 October 1984, we collected and examined 99 adult common snook and found numerous running ripe males but only one ripe female (October 1). Through the end of December, no ripe females were collected. Apparently, most spawning occurred in July and August while daylength was decreasing (12.6 h daylight in April, 13.9 h in June, 11.6 h in October; Anonymous, 1984) and water temperature was highest. The general temperature trend was: 22°C in early April, 28°C in early June, a peak of 30-31°C in July, 24-28°C in late September and October, 20-25°C in November, and 20°C in December; winter temperatures are usually in the range 15-20°C. In 1984, upwelling of slope water caused two temporary decreases in water temperature, to 18.6°C in late August and 21.4°C in late September. In 1985, there were three temporary decreases, to 20.0°C in late August, 20.6°C in late September, and 22.2°C in late October. Extreme tides occur in September, providing stronger currents to assist early juveniles in entering their preferred habitats of shallow fresh and brackish water marshes (Gilmore et al., 1983). During both years, monthly rainfall reached a peak in September, conforming to historical patterns (i.e., 30-year means, U.S. Weather Bureau records). Increased rainfall can open up more nursery habitat along the margins of estuaries. Possibly the end of spawning is associated with reduced estuarine salinity at this time of year. Nearly all the September 1984 rainfall occurred during four days, September 17-20. This caused a sudden decrease in salinity in the Indian River from 32°/oo to 18°/oo. The reproductive strategy of an Australian centropomid, the barramundi *(Lates calcarifer)*, seems to parallel that of snook (Davis, 1982, 1985; Russell and Garrett, 1985). Around northern Queensland, they spawn in the early evening during late spring and summer (October through February), stopping soon after the wet monsoon begins. Early juveniles and adults occupy habitats similar to those of snook.

ACKNOWLEDGMENTS—We thank Stan Blum, Blake Faulkner, Cal Hayes, Jerry Metz, and Fred Ward for collecting specimens and data and Pat Linley for assisting with the histology. The Florida League of Anglers provided preliminary funding for the study. This is contribution number 565 from Harbor Branch Oceanographic Institution.

LITERATURE CITED

ANONYMOUS. 1984. The nautical almanac for the year 1984. U.S. Government Printing Office, Washington, DC.

BRUGER, G. 1987. Florida Department of Natural Resources, Personal Communication.

DAVIS, T. L. O. 1982. Maturity and sexuality in barramundi, *Lates calcarifer* (Bloch), in the Northern Territory and south-eastern Gulf of Carpentaria. Aust. J. Mar. Freshw. Res. 33:529-545.

________. 1985. Seasonal changes in gonad maturity, and abundance of larvae and early juveniles of barramundi, *Lates calcarifer* (Bloch), in Van Diemen Gulf and the Gulf of Carpentaria. Aust. J. Mar. Freshw. Res. 36:177-190.

FORE, P. L., AND T. W. SCHMIDT. 1973. Biology of juvenile and adult snook, *Centropomus undecimalis,* in the Ten Thousand Islands, Florida, Chap. 16. *In:* Ecosystems Analyses of the Big Cypress Swamp and Estuaries. U.S. Environmental Protection Agency, Surveillance and Analysis Division, Athens, Georgia.

GILMORE, R. G., C. J. DONOHOE, AND D. W. COOKE. 1983. Observations on the distribution and biology of east-central Florida populations of the common snook, *Centropomus undecimalis* (Bloch). Florida Scient. 46:313-336.

Hunter, J. R., and B. J. Macewicz. 1985. Measurement of spawning frequency in multiple spawning fishes, pp. 79-94 *In:* Lasker, R. (ed.). An egg production method for estimating spawning biomass of pelagic fish: application to the northern anchovy, *Engraulis mordax.* NOAA Tech. Rep. NMFS 36.

Lau, S. R., and P. L. Shafland. 1982. Larval development of snook, *Centropomus undecimalis* (Pisces: Centropomidae). Copeia 1982:618-627.

Marshall, A. R. 1958. A survey of the snook fishery of Florida, with studies of the biology of the principal species, *Centropomus undecimalis* (Bloch). Fla. St. Bd. Conserv. Tech. Ser. No. 22, 39 p.

Rivas, L. R. 1986. Systematic review of the perciform fishes of the genus *Centropomus.* Copeia 1986:579-611.

Russell, D. J., and R. N. Garrett. 1985. Early life history of barramundi, *Lates calcarifer* (Bloch), in north-eastern Queensland. Aust. J. Mar. Freshw. Res. 36:191-201.

Volpe, A. V. 1959. Aspects of the biology of the common snook, *Centropomus undecimalis* (Bloch) of southwest Florida, Fla. St. Bd. Conserv. Tech. Ser. No. 31, 37 p.

Wallace, R. A., and K. Selman. 1981. Cellular and dynamic aspects of oocyte growth in teleosts. Amer. Zool. 21:325-343.

Florida Sci. 51(1):1-6. 1988.
Accepted: March 10, 1987.

Biological Science

THE YEAST COMMUNITY ASSOCIATED WITH DECAYING *OPUNTIA STRICTA* (HAWORTH) IN FLORIDA WITH REGARD TO THE MOTH, *CACTOBLASTIS CACTORUM* (BERG).

William T. Starmer[1], Virginia Aberdeen[1] and Marc-Andre Lachance[2]

[1]Biology Department, Syracuse University, Syracuse New York 13244-1270; [2]Department of Plant Sciences, University of Western Ontario, London, Ontario, Canada N6A 5B7

Abstract: *The yeast communities of decaying cladodes and fruits of two large stands of* Opuntia stricta *in the area of Cape Canaveral, Florida, were investigated. The yeast community was comparable in many ways with those of* O. stricta *in the Caribbean and in Australia. Many important differences were observed as well, some of which may be attributable to the absence, in Florida, of* Cactoblastis cactorum, *a moth used extensively elsewhere for the biological eradication of prickly pear cactus as a weed.*

Biological control of prickly pears in New South Wales and Queensland, Australia has been one of the most successful examples of eradication of a weedy, undesirable and economically disatrous spread of an introduced plant. Control was achieved by the successful establishment of the moth *Cactoblastis cactorum* (Berg) from material collected by Dodd in 1925 in Entre Rios, Argentina. Along with the introduction of *C. cactorum* a number of other insects of 48 different species were imported during the Australian campaign against the pest pear. The majority of this activity took place between 1927 and 1930 with 67 different shipments of cut plant material infested with the larval stages of the insects. Most shipments (59) came from the United States with sources of material extending from Florida and Texas to Mexico, while 8 shipments were sent from South America (Dodd, 1940). As a result the South American *C. cactorum* was established and was effective. Subsequently, all populations of *C. cactorum* used in other parts of the world for biological control have originated from Australia and ultimately from Dodd's original collection of 3000 eggs brought from South America to Australia (McFadyen, 1985).

We have been studying the yeasts of necrotic cactus in several regions of the world with the goal of gaining a better understanding of community organization and insect-vector associations of the microbes. We have found that the rotting tissue of the Australian pest pear (*Opuntia stricta* Haworth) contains similar yeast communities as compared to necroses of *O. stricta* sampled from its native distribution in the Caribbean (Starmer et al., 1987). This similarity is probably due to large scale introductions of cactus yeast communities during the control program but is partly confounded by the importation of *Cactoblastis cactorum* from Australia to the Leeward Islands (Nevis) of the West Indies in 1957 (Garcia Tuduri et al., 1971). Subsequent to its introduction into the West Indies, the moth has spread from Nevis

Island and Montserrat in 1960 to the US Virgin Islands and Puerto Rico in 1963. We have detected *C. cactorum* breeding in *O. stricta* in the Bahamas (Great Inagua in 1983) and suspect that a north-westerly spread to the Florida peninsula is imminent. We have therefore made an attempt to document the presence or absence of *C. cactorum* in Florida and to determine the yeast communities present in the decaying tissues of *O. stricta* in Florida.

MATERIALS AND METHODS—Decaying cladodes and fruits of *Opuntia stricta* were sampled for yeasts on December 3, 1986 at two localities in Florida. The first locality was near the entrance to Playalinda Beach within the Canaveral National Seashore. The second locality was about 4-5 miles south near launch area A complex 39 at the Kennedy Space Center. Several hundred plants were present at both sites. Approximately $^1/_2$g of tissue was removed from the decaying cladodes or fruits and suspended in 5 ml of sterile water. This suspension was shaken and one loopful was streaked on acidified yeast extract-malt extract (YM Difco) agar. Plates were incubated at room temperature (approximately 25°C) and distinct morphological colony types were picked and restreaked for identification by standard recommended techniques (van der Walt and Yarrow, 1984). A total of 31 cladodes and 31 fruits were sampled and in most cases one cladode and one fruit were sampled from the same plant. Even though the percentage of each type of yeast recognized by their different colony morphologies were estimated for each sample only the observations as occurrences per plant will be reported here. Larval samples of *Drosophila* Fallen species found feeding in the rotting samples were reared for identification, because *Drosophila* species may serve as important vectors of yeasts in this system.

RESULTS—There was no evidence of *Cactoblastis cactorum* present at either site. The frequency of decaying pads was nevertheless high and infestation by cochineal insects was common. The plants were robust and in full fruit. Two *Drosophila* species were reared from the decaying tissue. *Drosophila mulleri* (Sturtevant) was recovered from cladodes while both *D. mulleri* and *Drosophila melangoaster* (Meigen) were bred from the fruits. Similar host tissue use occurs on Caribbean islands (W. B. Heed, unpublished data). The yeast species recovered for both sites and tissue types are listed in Table 1. Those samples of cladodes and fruits that were taken in pairs are listed in Table 2. Those four yeast species *(Candida sonorensis, "Pichia amethionina* var *fermentans," Pichia kluyveri,* and *Pichia barkeri)* which were found in both cladodes and fruits were distributed randomly ($X^2 + 0.0$, 0.67, 2.41 and 1.01 respectively; df = 1, $P > 0.05$ for all cases).

DISCUSSION—It is apparent from Table 1 that the yeast communities of fruit and cladodes are distinct but that they share some species. Table 2 supports this conclusion by showing that neighboring fruits and cladodes have little overlap in the types of species that were recovered from them. When a yeast occurred in both cladodes and fruits its co-occurrence due to being in close proximity (i.e. the same plant) was not significantly different from random expectation. A previous report (Starmer et al., 1987) also documents the differences between communities of these two tissue types. In some cases the overlap in species can be greater; for example the yeast found in necrotic green fruit on Cayman Brac in the Caribbean were similar to the neighboring cladode yeasts. In addition when fruits are rare relative to pads then the yeasts of the two communities can be similar.

TABLE 1. Comparison of the yeasts isolated from cladodes and fruits of *Opuntia Stricta* in the Cape Canaveral area.

Yeast species	Sample type	
	Cladode	Fruit
Pichia cactophila Starmer et al.	17	
"*Pichia amethionina* var. *fermentans*"[1]	11	3
Pichia kluyveri Bedford	2	3
Pichia barkeri Phaff et al.	3	10
Candida sonorensis (Miller et al.) Meyer et Yarrow	14	2
Sporopachydermia cereana Rodriguez de Miranda[2]	3	
Candida mucilagina Phaff et al.	7	
Candida boidinii Ramirez	4	
Candida guilliermondii (Castellani) Langeron et Guerra	1	
Geotrichum Link ex Persoon sp.	6	
Prototheca zopfii Kruger	5	
Hanseniaspora guilliermondii Pijper		4
Kloeckera apis Simione et Meyer	1	19
Kloeckera apiculata (Niehaus) Shehata, Mrak et Phaff		5
Pichia membranaefaciens Hansen		2
Candida valida (Leberle) van Uden et Buckley, type 1[3]		6
Candida valida (Leberle) van Uden et Buckley, type 2[3]		1
Issatchenkia terricola (van der Walt) Kurtzman et al.		7
Candida krusei (Castellani) Berkhout		1
Clavispora opuntiae Phaff et al.		1
Zygosaccharomyces fermentati Naganishi		1
Candida stellata (Kroemer et Krumbholz) Meyer et Yarrow		1

[1] An undescribed variety of *Pichia amethionina* Starmer et al.

[2] Complex of several species.

[3] Asporogenous forms similar to *Pichia membranaefaciens;* type 1 differed from type 2 by its ability to assimilate sorbose and xylose.

Starmer and coworkers (1987) compared the yeasts from decaying cladodes and fruits collected from *O. stricta* in Australia and the Caribbean. They suggested that the cladode-microorganism system was a relatively closed system in which *Drosophila* species act as yeast vectors, thus determining to some degree what microbes were being distributed from cladode to cladode. The fruit-microorganism system was viewed as relatively open with many other insects (other dipterans, bees, wasps, beetles, ants, etc.) as well as birds serving as potential vectors of yeasts. This large extrinsic influence might therefore account for the large across region variability observed for fruit-yeast communities.

Three yeasts are particularly interesting with respect to their associations and geographic distributions. These are *Pichia norvegensis* Leask et Yarrow, "*Pichia amethionina* var *fermentans*" and *Clavispora opuntiae*. *Pichia norve-*

TABLE 2. Detail of pairwise collections from cladodes and fruits. For each plant sampled (a to x), the recovery of yeast isolates from cladode only (C), fruit only (F), or both (B) cladode and fruit is shown.

	Canaveral National Seashore									Kennedy Space Center															Total	
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	C	F
P. cactophila						C	C	C		C	C		C	C	C	C		C	C	C		C		C	14	
C. mucilagina									C				C		C	C	C	C		C					7	
Geotrichum sp.	C					C												C							3	
P. zopfii					C									C		C									3	
S. cereana cplx.													C									C			2	
C. boidinii								C							C										2	
C. sonorensis	C				C	C	C		C		C			C	C		C	C	F	B		C			12	2
"P. amethionina v. *f"*				C	C	C				F		F			C		C	C				C		C	8	2
P. kluyveri		C					F			B					F										2	3
P. barkeri		C	F	F	F		F	C		F	F		F	C								F			3	8
Z. fermentati						F																				1
C. krusei																		F								1
C. valida type 2																					F					1
C. stellata																						F				1
P. membranaefaciens																					F		F			2
K. apiculata												F	F											F		3
H. guilliermondii																F				F		F	F			4
I. terricola		F				F	F	F							F											5
C. valida type 1					F			F				F		F				F	F							6
K. apis			F	F	F	F		F		F				F	F			F	F		F		F			12

gensis was not recovered from the samples taken in Florida nor those taken in Australia but was commonly encountered in the Caribbean survey. This species has been obtained in previous collections from *Opuntia* cladodes in areas that are considered semi-arid, had considerable livestock in the vicinity, and were in close proximity of human habitation. These areas include the cape region of Baja California, Mexico; the Parker Ranch, Hawaii, USA; and rarely from the southwestern United States (Starmer et al., 1987 and unpublished results). We expect that the common occurrence of this species in the Caribbean, Hawaii and Baja California is possibly due to one or more of the above factors.

The distribution of two of the three known varieties of *Pichia amethionina* appears to follow a gradient whose extremes are *Opuntia phaeacantha* (Englemann) in Arizona (Starmer, Phaff, and Lachance, unpublished data) and *Opuntia stricta* in the Caribbean. In the first instance, the variety *amethionina* predominates, whereas Caribbean samples contained the variety *"fermentans"* exclusively. Given that samples of *Opuntia lindheimeri* (Englemann) collected in Texas by Starmer and Phaff (1983) contained a significant number of isolates of both varieties, it was of interest to find the variety *"fermentans"* was the only one found in Florida. This observation suggests that the Floridian yeast community has a large Caribbean or host-plant *(O. stricta)* influence.

The absence of *Catoblastis cactorum* from the sites sampled in Florida is accompanied by the relatively low frequency of *Clavispora opuntiae* (i.e. none in cladode and one in the fruit samples). Although this coincidental absence may well be due to other factors, there is some suggestion that *Clavispora opuntiae* is associated with rots initiated by the infestation of *C. cactorum*. *Clavispora opuntiae* was frequently isolated from both cladodes and fruits in both eastern Australia and the Caribbean where *C. cactorum* was present (Starmer et al., 1987). However, in localities where *C. cactorum* was not present (i.e. Metz Gorge, New South Wales, Starmer et al., 1987) the yeast *Clavispora opuntiae* was absent. We have not studied the adult moths for the microbes they carry, but one larva of *C. cactorum* collected in Australia had only one yeast associated with it. That yeast was *Clavispora opuntiae*. A definitive answer to the question of whether the yeast depends on the moth for its dispersal should come when the adult moths and their egg sticks are inspected for associated yeasts.

ACKNOWLEDGMENTS—We appreciate the cooperation of Dr. Ross Hinkle and Dr. Paul Schmaltzer at the Kennedy Space Center. We thank the Superintendent of the Canaveral National Seashore for permission to collect in that area. This work was supported by an NSF grant to W.T. Starmer BSR-8413168 and an NSERC (Canada) grant to M.A. Lachance.

LITERATURE CITED

DODD, A. P. 1940. The biological campaign against prickly-pear. Govt. Printer, Brisbane, Australia.

GARCIA TUDURI, J. C., L. F. MARTORELL AND S. MEDINA GAUD. 1971. Geographical distribution and host plants of the cactus moth *Cactoblastis cactorum* (Berg) in Puerto Rico and the United States Virgin Islands. J. Agr. Univ. Puerto Rico. 55: 130-134.

MCFADYEN, R.E. 1985. Larval characteristics of *Cactoblastis* spp. (Lepidoptera: Pyralidae) and the selection of species for biological control of prickly pears (*Opuntia* spp.). Bull. Ent. Res. 75:159-168.

STARMER, W. T. AND H. J. PHAFF. 1983. Analysis of the community structure of yeasts associated with the decaying stems of cactus. II. *Opuntia* species. Microb. Ecol. 9: 247-259.

________, M. A. LACHANCE, AND H. J. PHAFF. 1987. A comparison of yeast communities found in necrotic tissue of cladodes and fruits of *Opuntia stricta* on islands in the Caribbean Sea and where introduced into Australia. Microb. Ecol. 14(2):179-192.

VAN DER WALT, J. P. AND D. YARROW. 1984. Methods for the isolation, maintenance, classification and identification of yeasts. Pp 45-104. In: KREGER-VAN RIJ, N.J.W. (ed), The Yeasts, A Taxonomic Study, 3rd ed, Elsevier Science Publishers B.V., Amsterdam.

Florida Sci. 51(1):7-11. 1988.
Accepted: July 8, 1987.

OSTEOLOGY OF THE PREHISTORIC BOYNTON BEACH INDIANS

M. YAŞAR İŞCAN AND MORTON H. KESSEL

Department of Anthropology, Florida Atlantic University, Boca Raton, FL 33431-0991

ABSTRACT: *The Boynton Beach Mound site (8Pb100) is an inland burial and midden mound complex in South Florida dating from 150 B.C. (Glades I) to the time of European contact. This paper describes and analyzes the skeletal characteristics of the occupants and compares this group with other Southeast Indians.*

The burial population consisted of 23 calvaria and 12 postcranial partial skeletons representing 16 females and 8 males. Juvenile mortality rate (29%) was high compared with other sites, but 13% lived past 50 years. Stature of one male was at least 171 cm; stature of one female was about 155 cm. Adult teeth were generally worn horizontally to the dentin, and had no caries. Two skulls showed unusual deformation. With the exception of a case of periostitis, skeletal health was generally good.

THE Boynton Beach Mound complex is a Circum-Glades inland site approximately 16 km west of the city of Boynton Beach, Florida (Jaffee, 1976). Archaeological evidence provided the cultural, temporal, and spatial context of the skeletal remains. Excavation began in April 1973 by the Palm Beach County Archaeological Society under the direction of Kenneth Horton, and was continued in November 1973 by Howard Jaffee (Jaffee, 1976). Radiocarbon dates obtained from samples taken at depths of 142 cm and 91 cm were 150 B.C. and A.D. 400 ± 60, respectively.

As reported by Jaffee (1976), the excavated portion of the site consisted of a midden and a burial mound which were part of a larger complex of approximately ten mounds and associated causeways or linear embankments. They were constructed with white sand (pH 4.5) not found in the immediate area and laid down on a muck floor. Underlying this was the Anastasia formation of calcareous sandstone and sandy limestone. The sand was probably brought in to compensate for water levels that had risen gradually over the last 2000 years (Fairbridge, 1974; Milanich and Fairbanks, 1980).

Artifacts recovered included a preponderance of different style potsherds, a few lithics, a copper cartridge case (found in the midden), and 400 year old glass trade beads found in association with skeletal material. The latter two are likely evidence of European contact. According to Jaffee (1976), the skeletal remains were found in bundle burials, suggesting that the mound was a secondary burial site. However, the late Dr. Audrey Sublett of Florida Atlantic University excavated one partial skeleton which may have been "put down in the flesh," implying a primary burial.

The present paper describes and analyzes the skeletal materials found at the Boynton Beach Mound complex designated 8Pb100 (originally 8Pb56) (Fig. 1). The characteristics of these individuals are compared also with other Southeast Indian populations.

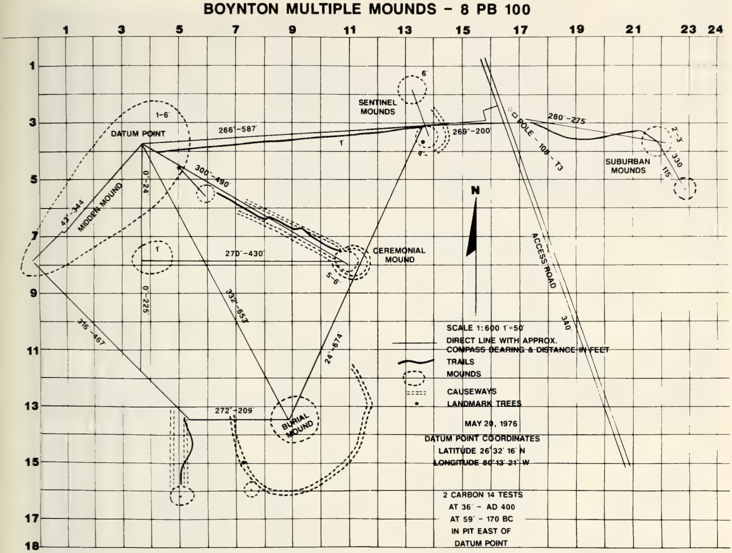


FIG. 1—Site map of the Boynton Beach Mound at scale 1:600, 1″ = 50’ (courtesy of F. Morrison).

MATERIALS AND METHODS—The authors received the fragmented, eroded skeletal material in several plastic bags, some containing the remains of more than one individual. All bones had been coated with a preservative because of their fragile condition. Most of the cranial material could best be described as calottes (skull caps without base or face). The postcranial elements were extremely fragmented with evidence of attempted restoration. Assessment of sex, age and stature followed standard osteological practice. Sex was determined from cranial and postcranial metrical and morphological features (Bass, 1971; Black, 1978; İşcan and Miller-Shaivitz, 1984; Krogman and İşcan, 1986). Age was estimated from cranial suture closure, tooth eruption, dental wear and fusion of long bone epiphyses (Brothwell, 1981; Krogman and İşcan, 1986).

Estimation of stature was possible in only two fragmentary specimens using the sector regression formulae of Steele and McKern (1969) and Genovés (1967). Anomalies and pathological lesions were diagnosed based on criteria presented by Brothwell (1981), El-Najjar and McWilliams (1978), Morse (1978), Ortner and Putschar (1981) and Živanović (1982).

RESULTS—The skeletal material included the partial skulls and teeth of 23 individuals and the postcranial remains of 12. No definite association could be made between the skulls and postcranial skeletons leading the authors to assume a maximum of 35 individuals. The inventory of cranial and postcranial material appears in Table 1. Some of the specimens are illustrated in Fig. 2. As can be seen in the table, 8 individuals were judged males, 16 females, and the remaining 11, indeterminate. Of the 24 age estimates, 7 were juveniles and 17 were adult, 3 of which were over 50.

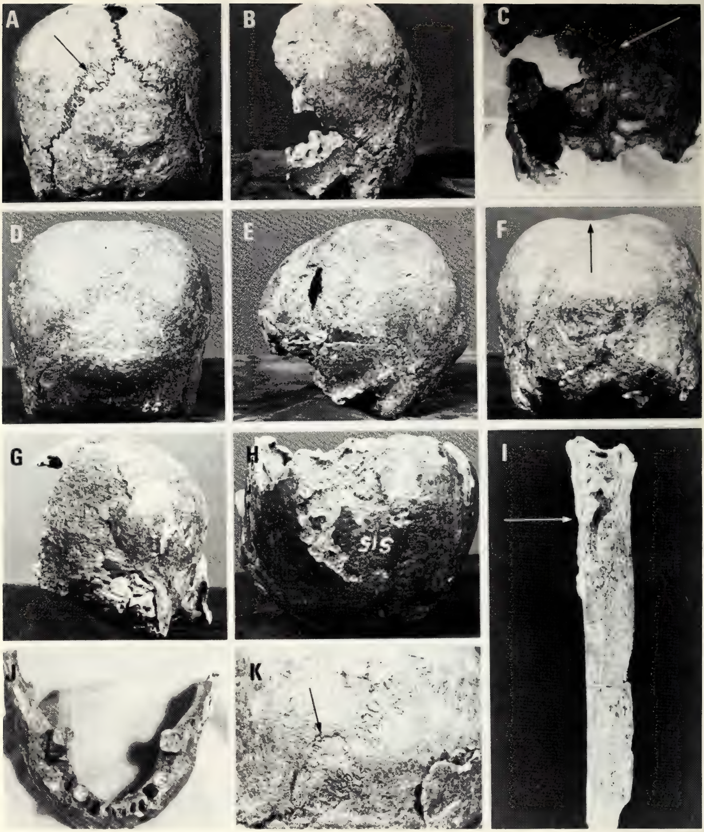


FIG. 2—(A) S11 norma occipitalis showing Wormian bones, (B) S11 norma lateralis (sin.) with extreme occipital flattening, (C) S4 illustrating pseudopathological pitting, (D) S7 norma occipitalis, (E) S7 norma lateralis (sin.) showing occipital bulge, (F) S7 with a unique valley in sagittal suture and lobate parietals, (G) S16 showing postmortem erosion, (H) S15 displaying postmortem erosion, (I) Bla femur suggesting periostitis, (J) S4 mandible with tooth wear, and (K) S14 norma occipitalis with Wormian bone.

Table 2 summarizes the metric data, indices and descriptive statistical analysis of the cranial and postcranial material. Table 3 compares the Boynton Beach specimens with individuals from other South Florida sites including Fort Center (Miller-Shaivitz and Íşcan, 1988), Margate-Blount (Íşcan, 1983) and Bayshore Homes (Snow, 1962). Stature was calculated for one

TABLE 1. Cranial and postcranial remains from the Boynton Beach Mound by sex and age.

Field No.	Sex	Age(yrs)	Bones Present
Cranial			
S1	F	adult	calva
S2a	M	50+	calva
S2b	?	18-20	mandible, teeth
S3a	F	adult	calva fragments
S3b	M	adult	calva fragment
S4	F	50+	calva
S5a	M	adult	calva, R. mandible, loose teeth
S5b	?	juvenile	loose teeth
S6	?	adult	calva, loose teeth
S7	F	adult	calvarium
S8	?	adult	calva
S9	F	adult	calva
S10	F	20-25	mandible, maxilla frags.
S11	F	18+	calvarium, R. maxilla frag., teeth
S12	?	adult	R. parietal fragment
S13	F	15-18	occipital, R. parietal, R. temporal
S14a	F	adult	calvarium, mandible, teeth, C2-C4, L. petrous portion, occipital frag.
S14b	?	?	C2
S15a	F	adult	calva, mandible body
S15b	M	?	occipital and frontal fragments.
S16a	F	55+	calva, frags: maxilla, L. petrous portion, R. spheno-temporal, teeth
S16b	?	juvenile	teeth, petrous portion
S17	?	21-	mandible frags., maxilla and teeth
Postcranial			
B1a	F	?	L. & R. ulnae prox. diaph., L. & R. femora diaph., L. fibula diaph., L. & R. tali, R. calcaneous
B1b	?	?	tibia diaph.
B2	M	?	L. & R. femora, L. & R. tibiae, R. fibula, L. ulna, L. & R. innominates, tarsals
B3a	F	adult	clavicle, humerus, L. & R. femora, tibia, skull frags., molar frags.
B3b	F	?	R. femur
B4a	M	10-15	L. femur, L. & R. tibiae, patella frag., L. & R. innominate frags.
B4b	?	adult	L. & R. femora
B5	?	?	L. & R. tibiae, L. & R. calcanei
B6a	F	?	L. humerus, L. & R. femora, fibula frag.
B6b	M	?	L. femur
B6c	F	?	R. femur
B7	M	?	L. & R. humeri, L. & R. femora, L. ulna, R. radius, L. & R. innominates

Totals		M	F	?	Juv.	Adult	?
Cranial	N=23	4	11	8	6	15	2
Postcranial	N=12	4	5	3	1	2	9

male (B2) as greater than 171 ± 3.4 cm using a formula developed by Genovés (1967); stature of one female (B6a) was estimated to be 155 ± 3.8 cm (Steele and McKern, 1969; Bass, 1971).

Physical Characteristics and Pathological Lesions—All of the cranial material evidenced extensive postmortem erosion (Fig. 2G-H). Skull S4 had pseudopathological pitting endocranially at the junction of the sagittal and lambdoid sutures (Fig. 2C). The femur of Bla showed severe periostitis (Fig. 2I). There were no cases in which a clear-cut cause of death could be established. With the exception of deciduous and newly erupted dentition, all teeth showed varying degrees of horizontal wear at the occlusal surfaces,

TABLE 2. Cranial and postcranial dimensions (in mm) of the Boynton Beach Mound population.

Cranial measurements	N	$\bar{X}$	S.D.
Glabello-occipital length	2	170	7.8
Bregma-lambda chord	3	103	3.1
Lambda-opisthion chord	5	112	13.9
Parietal arc	3	115	2.5
Occipital arc	5	119	9.4
Horizontal circumference	1	488	-
Maximum vault breadth	6	145	6.0
Foramen magnum, length	2	35	0.0
breadth	2	30	0.7
Left parietal thickness	16	6	1.0
Orbital breadth, right	1	40	-
Chin height	2	30	4.2
Bi-gonial breadth	1	89	-
Bi-mental breadth	4	46	0.6
Gonion-symphysion length	1	90	-
Minimum ramus breadth	2	35	2.8
Corpus thickness (M1)	4	14	2.1
Molar length (M1 + M2 + M3)	3	33	2.3

Postcranial measurements		Males			Females
		B2	B4a	B6b	B6a
Humerus	max midshaft	-	-	21	-
	min midshaft	-	-	18	-
Femur	max length	>473	-	-	407
	subtroch a-p	-	-	-	20
	subtroch trans	-	-	-	26
	midshaft a-p	-	-	-	25
	midshaft trans	-	-	-	20
Tibia	a-p dia. at	-	33	-	-
	nutrient foramen	-	-	-	-
	transv. dia. at	-	22	-	-
	nutrient foramen	-	-	-	-
Stature		>1708	-	-	1547
Platymeric Index		-	-	-	76.9
Platycnemic Index		-	66.7	-	-

frequently exposing the dentin (Fig. 2J). Several instances of antemortem tooth loss with subsequent alveolar resorption were noted also. Many of the teeth in both mandibles and maxillae were found to have been damaged during excavation and subsequent handling. There was no evidence of caries, abscess formation, interproximal grooving or hypoplasia. The maxillary central incisors of S16a were shovel shaped.

Single Wormian bones were observed in the lambdoid sutures of S6, S7, S9, and S14 some of which are illustrated in Fig. 2D and K. In addition to four Wormian bones, S11 showed extreme occipital flattening (Fig. 2A-B). Skull S7 had an unusual deformation, a 4 mm deep depression or valley extending along the sagittal suture between lobate parietal bones (Fig. 2D-F). Interestingly, there was no accompanying endocranial depression. A cranial index of 90.9 placed this specimen in the hyperbrachycranic range. This skull also exhibited a pronounced occipital bulge. (Fig. 2E).

Conclusions—Skeletal remains can provide significant information about individuals who inhabited a given region many years ago (İşcan, 1983; Carr et al., 1984; İşcan and Kennedy, 1987). The Boynton Beach Mound material, however limited, adds to our knowledge of the biology of Southeast Indians.

Both differences and similarities were uncovered between this group and the comparative populations mentioned. Demographically, it was noted that female burials exceeded males by 100%. The ratios were not as disparate at the other sites, with females ranging from 6% fewer to 25% more than males. By age, individuals under 21 were represented more frequently (29%) than at Fort Center (16%) and Margate-Blount (19%).

The tooth wear pattern was similar to that noted among other coastal populations whose diet included quantities of gritty shellfish. These Indians likely made excursions to the coast, about 16 km away, to exploit seasonal food resources. The absence of caries is consistent with a preagricultural, seminomadic, hunting and gathering way of life (Isler et al., 1985).

The prehistoric Boynton Beach group showed a greater incidence of mortality in the first two decades of life, although more data are needed to establish causality. Yet, the general health of this population appeared to be good, with only one instance of periostitis (Fig. 2I).

The most notable abnormalities in the collection were ostensibly intentional cranial deformations. While the skull configuration of S11 is suggestive of cradle board deformity, the absence of facial and frontal bones precluded a more certain diagnosis (Stewart, 1939; Brues; Ubelaker, 1978). The cause of numerous anomalies observed in S7 is much harder to pinpoint.

The Boynton Beach Mound site, at the margin of more culturally developed areas, is ideally located to test hypotheses relating to diet, population growth and biocultural adaptation. As such, it represents a valuable resource for further research.

ACKNOWLEDGMENTS—The authors thank the Board of Directors of the Palm Beach County Archaeological Society for making the collection of osteological material available for this study. Special recognition is due Frank and Clivia Morrison for the years they spent doing yeoman service at the site. Thanks are due also to S. R. Loth for editorial assistance, W. N. Watkins, D. R. DeFazio, and W. Sheehan for photography and S. M. Pennell for redrawing the map in Fig. 1.

LITERATURE CITED

BASS, W. M. 1971. Human Osteology: A Laboratory and Field Manual of the Human Skeleton. Special Pub. No. 2, Missouri Archaeol. Soc., Columbia.

BLACK, T. K. III. 1978. A new method for assessing the sex of fragmentary skeletal remains: Femoral shaft circumference. Am. J. Phys. Anthropol. 48:227-231.

BROTHWELL, D. R. 1981. Digging Up Bones: The Excavation, Treatment, and Study of Human Skeletal Remains. Cornell University Press, Ithaca.

BRUES, A. 1958. Skeletal material from the Horton Site. Bulletin, Oklahama Anthropol. Soc. 6:27-32.

CARR, R., M. Y. İŞCAN, AND R. A. JOHNSON. 1984. A late Archaic cemetery in south Florida. Florida Anthropol. 37:172-188.

EL-NAJJAR, M. Y., AND K. R. MCWILLIAMS. 1978. Forensic Anthropology. Charles C. Thomas, Springfield.

FAIRBRIDGE, R. W. 1974. The Holocene sea-level record in south Florida. Pp. 223-231. In: GLEASON, P. J. (ed.), Environments of South Florida: Present and Past. Miami Geological Society. Memoir No. 2.

GENOVÉS, S. C. 1967. Proportionality of long bones and their relation to stature among Mesoamericans. Am. J. Phys. Anthropol. 26:67-78.

İŞCAN, M. Y. 1983. Skeletal biology of the Margate-Blount population. Florida Anthropol. 36(3-4): 154-166.

_________, AND P. MILLER-SHAIVITZ. 1984. Determination of sex from the tibia. Am. J. Phys. Anthropol. 64:53-57.

_________, AND W. J. KENNEDY. 1987. Osteological Analysis of Human Remains from the Nebot Site. Florida Scient. 50:000-000.

ISLER, R., J. SCHOEN, AND M. Y. İŞCAN. 1985. Dental pathology of a prehistoric human population in Florida. Florida Scient. 48:139-146.

JAFFEE, H. 1976. Preliminary report on a midden mound and burial mound of the Boynton Mound Complex. Florida Anthropol. 29:145-152.

KROGMAN, W. M., AND M. Y. İŞCAN. 1986. The Human Skeleton in Forensic Medicine. Charles C. Thomas, Springfield.

MILANICH, J. T., AND C. H. FAIRBANKS. 1980. Florida Archaeology. Academic Press, New York.

MILLER-SHAIVITZ, P., AND M. Y. İŞCAN. 1988. The prehistoric people of Fort Center: Physical and health characteristics. In: BRIDGES, P. S., M. L. POWELL, AND A. M. MIRES (eds.). Southeastern Bioarchaeology: A Regional Perspective on the Dynamic Integration of Physical Anthropology and Archaeology. University of Alabama Press, Birmingham, AL, in press.

MORSE, D. 1978. Ancient Disease in the Midwest. Reports of Investigations, No. 15, Illinois State Museum, Springfield.

ORTNER, D. J., AND W. G. J. PUTSCHAR. 1981. Identification of Pathological Conditions in Human Skeletal Remains. Smithsonian Institution Press, Washington, D. C.

SNOW, C. E. 1962. Indian Burials from St. Petersburg, Florida. Contributions of the Florida State Museum, 8. Univ. Florida, Gainesville.

STEELE, D. G., AND T. W. MCKERN. 1969. A method for assessment of maximum long bone length and living stature from fragmentary long bones. Am. J. Phys. Anthropol. 1:215-227.

STEWART, T. D. 1939. Two new types of cranial deformation in the Southeast. Am. J. Phys. Anthropol. 25 (Suppl 1):10 (Abs. Nos. 5 and 6).

UBELAKER, D. H. 1978. Human Skeletal Remains: Excavation, Analysis, Interpretation. Aldine, Chicago.

ŽIVANOVIĆ, S. 1982. Ancient Diseases: Elements of Palaeopathology. Pica Press, New York.

Florida Sci. 51(1):12-18. 1988.
Accepted: July 10, 1987.

DENSITY AND DISPERSION ESTIMATES FOR SEA URCHINS IN A SOUTH FLORIDA SEAGRASS COMMUNITY

JEREMY R. MONTAGUE, LUISA ORTIZ, ALEXANDRA ARGUELLES,
JUSTINA M. MILLAN, AND LYNETTE CARDOCH

Division of Biological and Biomedical Sciences, Barry University, Miami Shores, FL 33161

ABSTRACT: *Sea urchins* (Lytechinus varigatus *and* Tripneustes ventricosus) *were collected from a shallow, subtidal seagrass community in Biscayne Bay during Summer 1986. The population density of urchins within patches of seagrass was first estimated with quadrat sampling (mean = 0.54 urchins/m²). The statistical dispersion of urchins among quadrats was random. Density later was assessed by mark-recapture (nail polish was painted onto urchin spines). The Petersen estimate of density (0.47 urchins/m²) appeared to be in close agreement with the quadrat estimate, though the estimates were not statistically comparable.*

GRAZING marine invertebrates can have significant impact on the productivity and structure of benthic communities. In particular, sea urchins within the sub-tropical seagrass meadows will affect seagrass biomass production since they are the only marine invertebrates which feed directly on living seagrass tissues (Thurman and Webber 1984). The long-term population dynamics of sea urchins within these communities are therefore of considerable interest.

Although there is recent information available on the primary productivity of seagrass species in South Florida waters (Jensen and Gibson 1986), little is known about urchin densities within patches of seagrass (Hay 1984). The purpose of this paper is to report two independently derived estimates of urchin density in a shallow seagrass community off Key Biscayne. These estimates provide the basis for the long-term study of population dynamics and community structure.

THE STUDY AREA—Our collections were made in a shallow, sub-tidal zone (0.5-1.0 m) along the northern shore of Key Biscayne (in The Bear Cut Channel). The coastline here is dominated by the red mangrove *(Rhizophora mangle).* We found three species of seagrass in the soft sediment: *Thallasia testudinum* (turtle grass), *Syringodium filiforme* (manatee grass) and *Halodule wrightii* (shoal grass). These species are abundant in soft-sediment communities of Biscayne Bay (Hanlon and Voss 1975). Several genera of macroalgae also were detected, including *Gracilaria* and *Acetabularia* (Humm 1976).

METHODS—In September 1986, we randomly selected ten 10-m transects across the collection site. At 1-m intervals, we placed a round glass plate (d = 20 cm) onto the benthic substrate, and the substrate was characterized by the material beneath the plate.

We collected two species of sea urchins from this site: *Lytechinus variegatus* (the more common species) and *Tripneustus ventricosus* (George and George 1979; Zeiller 1974). All collections were completed between 8 a.m. and 10 a.m. Only two specimens of *T. ventricosus* were found during Summer 1986.

We used a 2-m × 5-m collection grid (10 m²) to sample urchin density within patches of seagrass; each 1-m² quadrat was carefully searched by hand. To determine if the urchins were dispersed randomly among the quadrats, the observed dispersion was compared with a predicted Poisson dispersion. The Poisson dispersion was generated by the function (Eqn 1):

$$P(x=k) = \frac{e^{-\bar{x}}\,\bar{x}^{k}}{k!} \tag{1}$$

where $\bar{x}$ = sample mean urchin density per m^2 and k = number of urchins per quadrat (k = 0, 1, 2, ...). In the predicted Poisson dispersion, the sample mean and sample variance are equal, and the theoretical urchins are dispersed randomly (Rhoghati 1976). The observed and predicted dispersions were then compared by Chi-square goodness-of-fit analysis.

We used a mark-recapture census in July 1986, to estimate population density within a 225-m^2 area at the collection site. We painted a small amount of nail polish onto the aboral urchin spines, and released the animals in the center of the collection site (38 marks released on 15 July). A simple Petersen estimate was calculated, as follows: m_1 = number of marks released on day 1 (38 urchins on 15 July), m_2 = number of recaptured marks on day 2 (17 urchins on 16 July), n = total number (marked and unmarked) captured on day 2, (49 urchins on 16 July), and N = total population in 225 m^2 collection area. Assuming $m_2/n = m_1/N$, then $N = m_1 n/m_2$ (Begon 1979).

RESULTS AND DISCUSSION—Our transect-intersect method revealed a variable benthic substrate within the collection site. Of the 100 intercept points, 78 contained seagrass, five contained macroalgae only, and 17 contained sand only. Urchins clearly preferred to remain within patches of the seagrass.

The mean numbers of urchins per quadrat are shown in Table 1. The highest density was observed on 17 June, while the lowest density was observed on 8 July. Since these data are counts/m^2, they should be Poisson-distributed rather than normally distributed (Sokal and Rahlf 1987). To compare mean densities between dates, we transformed the raw counts with a square-root function, and calculated means for t-tests. The 8 July density was statistically lower than the other three (Table 1). It is likely that night collections would reveal a different pattern, though Hay (1984) noted that urchins which graze in *Thallasia* meadows in the Caribbean feed during day and night.

The dispersion of urchins among 1-m^2 quadrats is shown (Fig. 1). Most of the observed quadrats were empty. The observed dispersion was not significantly different from the predicted Poisson dispersion (Chi-square = 0.06, d.f. = 3, p = 0.91); the dispersion of urchins within patches of seagrass was therefore random.

TABLE 1. Mean number of urchins per m^2 (values in parentheses are mean and standard deviation values calculated from square-root transformed counts: cf. Sokal and Rohlf 1987, p. 218).

Date	Mean per m^2	Standard Deviation	Number of 1-m^2 Quadrats
6/17	0.70 (1.01)*	0.92 (0.38)	30
6/26	0.67 (1.02)	0.99 (0.42)	30
7/8	0.23 (0.82)	0.63 (0.27)	30
7/10	0.53 (0.94)	1.04 (0.39)	30
Overall	0.54	0.90	120

*Means calculated from transformed counts were compared with t-tests: there were no significant differences between means of 6/17, 6/26 or 7/10, but the 7/8 mean was significantly lower than the others.

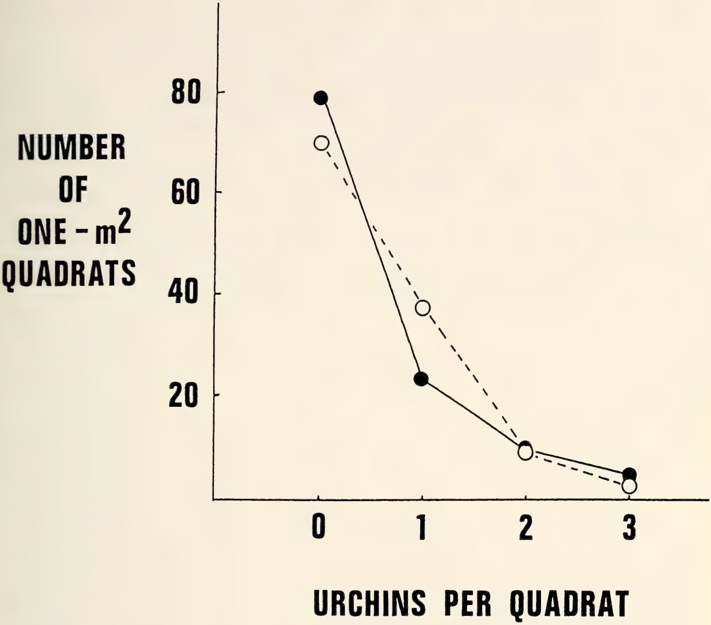


FIG. 1. Counts of urchins/quadrat; closed circles are observed counts, open circles are predicted random (Poisson) counts. Note that all counts of more than three urchins per m^2 are pooled in the three urchins per m^2 counts.

All of the recaptured marks were alive on 16 July. The Petersen estimate of density was 0.47 urchins/m^2, which appears to be in close agreement with the quadrat estimate (Table 1). However, the quadrat estimate was compiled over four separate sample dates, while the Petersen estimate came from a single collection taken after the completion of the quadrat sampling. Thus, the estimates are not statistically comparable, and the similarity may be spurious.

ACKNOWLEDGMENTS—We are grateful for the assistance and comments of the 1986 Marine Biology class at Barry University. Thanks also to Julia Thompson for her help with the manuscript. Support for this project was provided by the Minority Access to Research Careers Grant from NIH to Barry University (1 T34 GM-08021-01A1, Sister John Karen Frei, O.P., Ph.D., Program Director).

LITERATURE CITED

BEGON, M. 1979. Investigating animal abundance. University Park Press, Baltimore. pp. 97.
GEORGE, J. D. AND J. J. GEORGE. 1979. Marine life. Wiley-Interscience, New York: pp. 288.

HANLON, R. AND G. L. VOSS. 1975. A guide to the seagrasses of Florida, the Gulf of Mexico, and the Caribbean region. Univ. Miami Sea Grant, Field Guide Series, No. 4: pp. 30.

HAY, M. E. 1984. Patterns of fish and urchin grazing on Carribbean coral reefs: are previous results typical? Ecology. 65(2):446-454.

HUMM, H. J. 1976. The benthic algae of Biscayne Bay. In: Biscayne Bay: past, present, future (A. Thorhaug, Ed.). Univ. Miami Sea Grant, Special Report No. 5:71-94.

JENSEN, P. R. AND R. A. GIBSON. 1986. Primary production in three subtropical seagrass communities: a comparison of four autotrophic components. Florida Scient. 49(3):129-141.

RHOGHATI, V.K. 1976. An Introduction to Probability Theory and Mathematical Statistics. Wiley-Interscience, New York: pp. 684.

SOKAL, R. R. AND F. J. ROHLF. 1987. Introduction to Biostatistics. W. H. Freeman and Company, New York: pp. 363.

THURMAN, H. V. AND H. H. WEBBER. 1984. Marine Biology. Charles E. Merrill Publishing Company, Columbus, Ohio: pp. 446.

ZEILLER, W. 1974. Tropical Marine Invertebrates of Southern Florida and the Bahama Islands. Wiley-Interscience, New York: pp. 132.

Florida Sci. 51(1):19-22. 1988.
Accepted: July 17, 1987.

HERMAPHRODITISM IN THE ASTEROID *LUIDIA CLATHRATA* (SAY)

Paula F. Dehn[1]

Department of Biology, University of South Florida, Tampa, Florida 33620

Abstract: Luidia clathrata *is gonochoric. This is a report of a single incidence of hermaphroditism from more than 2000 individuals examined during the reproductive seasons of 1974-1979. The gonads are serial arborescent sac-like structures that are lined with germinal cells. Each gonad typically has four or five acini. In the hermaphroditic gonad both oocytes and sperm arose from the same area along the basal lamina. In some acini oocytes tended to dominate while in others sperm were predominant. In acini that contained large numbers of both gametes the sperm completely encircled the oocytes. There was no evidence of self fertilization. This hermaphroditic individual was part of a nutritional study. That only a single individual showed hermaphroditism indicates the tight control of sexual differentiation in this species.*

Three sexual patterns have been described for echinoderms: 1) stable gonochorism, 2) labile gonochorism, and 3) hermaphroditism (Cognetti, 1954; Cognetti and Delavault, 1960, 1962; Delavault, 1960, 1966). Stable gonochorism produces the typical one/one male/female ratio. Hermaphroditic individuals within this group represent an accidental phenomenon which cannot be dealt with experimentally (Boolootian and Moore, 1956; Delavault, 1966). In those individuals which exhibit labile gonochorism the number of hermaphroditic individuals may be predicted. Hermaphroditism represents a viable sexual alternative for some species. The occurrence of hermaphroditic individuals within a gonochoric species is of importance as it indicates that the potential for hermaphroditism exists within the species and provides information on the different types of hermaphroditism that can occur. It also may provide insight into the control mechanisms of sexual differentiation. *Luidia clathrata* is a primitive platyasterid asteroid which is gonochoric, as are the other members of the family. This paper reports the occurrence of a single incidence of hermaphroditism and describes the conditions under which it was found, as well as the appearance of the hermaphroditic gonads.

Materials and Methods—Over 2000 *Luidia clathrata* were collected from two locations along the west coast of Florida, Tampa Bay and Charlotte Harbor. Information on gonad composition and structure was gathered over a four year period for analysis of the reproductive cycle. Additionally, approximately forty groups of 10 individuals were maintained in the laboratory under controlled nutritional and temperature conditions at all stages of the reproductive cycle. The sex of these animals also was determined. At the time of examination body weight, radius length, the digestive gland and gonad weights were recorded. The organ indices were calculated (Eqn 1).

$$\text{Organ index} = \frac{\text{organ weight}}{\text{body weight}} \times 100 \qquad (1)$$

---

[1] *Current address: Division of Life Sciences, The University of Texas at San Antonio, San Antonio, Texas 78285*

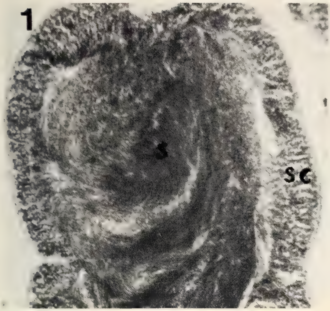
The gonads of all animals (both laboratory and field) were fixed in a modified Bouin's solution, sectioned at 10 um, and stained with hematoxylin-alcoholic eosin (Pearse, 1965).

Results—All of the animals examined immediately after collection were gonochoric. One of the individuals maintained in the laboratory under controlled conditions was hermaphroditic. This hermaphroditic individual was collected from Tampa Bay in April 1977, near the end of the reproductive season. The field animals at the time of collection had a mean digestive gland index (DGI) of 3.15 and a gonad index (GI) of 1.78. The hermaphroditic animal had an initial wet body weight of 30.6g and a radius length of 85mm. This animal was maintained at room temperature (23° ± 1°C) and fed an average of 0.223g dry weight of the bivalve, *Donax variabilis*, per week (% dry weight composition: protein = 49, carbohydrate = 13, lipid = 10). The hermaphroditic individual was examined 2 months later (June). It had a final weight of 29.6g, a radius of 82mm, a DGI of 3.95 and a GI of 10.17. Laboratory animals of the same feeding group as this hermaphroditic individual had a mean (± SE) DGI of 3.81 ± 0.83 and a GI of 4.41 ± 2.7. Field animals collected at the same time in June had a mean DGI of 4.14 and no gonads.

The gonads of *Luidia clathrata* are serial rather than the more typical one pair per ray. Each gonad opens to the exterior via a aboral gonopore. Each gonad contains 4 or 5 acini which are lined with germinal cells. During early stages of the reproductive cycle, testes of normal males show spermatic columns and sperm in the lumen (Fig. 1). The structure of the normal sperm and testis have been described elsewhere (Dehn and Hinsch, 1981; Hinsch and Dehn, 1979). The ovaries of normal females contain germinal cells along the basal lamina that seem to bud off, grow and move to the center of the lumen (Fig. 2). The oocytes contain a prominent germinal vesicle and nucleolus that disappear at spawning.

In the hermaphroditic gonad each acinus gives rise to both oocytes and sperm which arise from adjacent areas along the basal lamina (Fig. 3). Both spermatic columns and small developing oocytes are present. In some acini oocytes tend to dominate (Fig. 4) while in others sperm are predominant (Fig. 5). The sperm encircle the oocytes in those acini which contain large numbers of both gametes (Fig. 6). There was no evidence of self fertilization as there was no indication of germinal vesicle breakdown, fertilized or cleaving eggs, or embryos.

Discussion—Boolootian and Moore (1956) stated that ovotestes are not as common as separate ovaries and testes in hermaphroditic echinoids. In many cases where ovotestes have been found, the gonad seems to be divided along the radial length into upper, middle, and lower areas that were primarily ovarian, unisexual (containing both gametes), and testicular respectively (Boolootian and Moore, 1956; Cognetti and Delavault, 1962; Emson and Crump, 1976; Gonor, 1973). This also appears to be the case for *Luidia clathrata*. There were areas where either sperm or oocytes predominate and other areas which contained both abundant ovarian and testicular tissues.



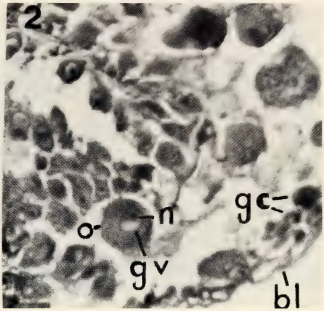
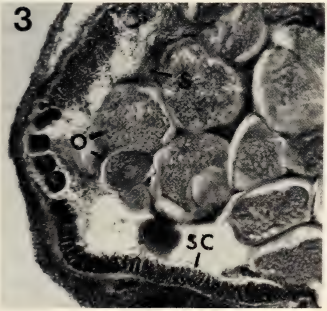


FIG. 1. Testis of a normal male *Luidia clathrata.* Spermatic columns (sc) and sperm (s) are visible (660x).

FIG. 2. Ovary of a normal female *Luidia clathrata.* Oocytes (o) bud off the germinal cells (gc) along the basal lamina (bl), grow and move toward the lumen. Oocytes have a prominent germinal vesicle (gv) and nucleolus (n) (660x).



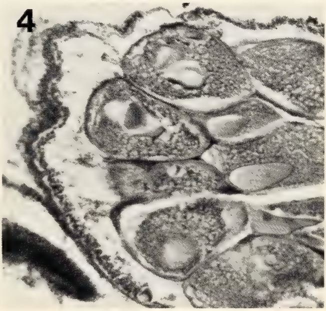
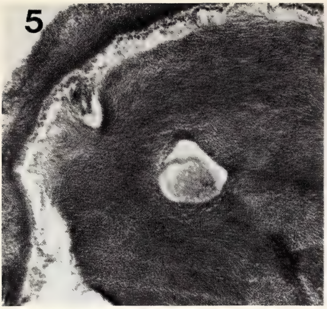


FIG. 3. Hermaphroditic gonad of *Luidia clathrata* showing both oocytes (o) and spermatic columns (sc) along the basal lamina. Sperm (s) are visible encircling the oocytes (1000x).

FIG. 4. Hermaphroditic gonad of *Luidia clathrata* with oocytes dominating(660x).

The occurrence of hermaphroditism even as an accidental phenomenon brings to question the possible causative factors of sex determinism. Delavault (1960, 1966), in reviewing the available information on sex determinism in echinoids, attributed labile gonochorism to some disturbance that affects cytodifferentiation in the gonad. Internal factors, e.g., steroids and androgens (Botticelli et al., 1960, 1961; Schoenmaker et al., 1976), and various external factors (Gonor, 1973; Moore et al., 1963 a, b) have been suggested to effect cytodifferentiation of gonads. Low population density has been shown to



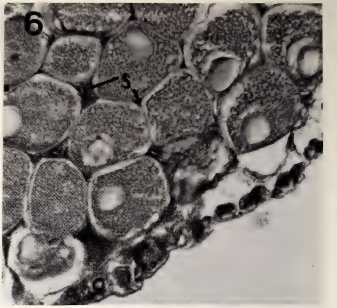


FIG. 5. Hermaphroditic gonad of *Luidia clathrata* with sperms dominating(660x).

FIG. 6. Sperm (s) encircle oocytes in areas which contain large numbers of both gametes (660x).

stimulate hermaphorditism in polychaetes (Grassle, 1984). There was no evidence of decreased population densities of *Luidia clathrata* in Tampa Bay during the Spring of 1977 when this hermaphroditic individual was collected (unpubl. obs.). However the overall size and condition of individuals, as evidenced by radius length, weight, and digestive gland and gonadal indices were lower than in the previous 6 years (Lawrence et al., 1986). Nutritional condition has been shown to occasionally produce hermaphrodites in fishes (Egami, 1955). This single incident of hermaphroditism in *Luidia clathrata* occurred in an individual that was part of a nutritional study. All 400 individuals of this study were examined. That only a single individual showed hermaphroditism indicates the tight control of sexual differentiation in this species. There is no way of knowing what factors were involved in the appearance of this hermaphroditic individual, but Boolootian and Moore (1956) point out the necessity for precise records and reporting of the occurrences of hermaphroditic individuals from a wide variety of organisms to form a basis for possible causative factors. In this way perhaps a solution to the problem of germinal cell morphogenesis in echinoderms may be found.

ACKNOWLEDGMENTS—I would like to thank John M. Lawrence for his guidance throughout the course of the study, Gertrude Hinsch for her helpful discussions on reproductive morphogenesis, and all those who helped with the collections in Tampa Bay. Also, special thanks to Steve Osborne and The Environmental Quality Lab, Inc. who supplied all the animals from Charlotte Harbor.

LITERATURE CITED

BOOLOOTIAN, R.A. AND A.B. MOORE. 1956. Hermaphroditism in echinoids. Biol. Bull. 3:328-335.

BOTTICELLI, C. R., F. L. HISAW, JR., AND H. H. WOTIZ. 1961. Estrogens and progesterone in the sea urchin *(Strongylocentrotus franciscanus)* and pecten *(Pecten hericius)*. Proc. Soc. Exp. Biol. 106:887-889.

________, F. L. HISAW, JR., AND H.H. WOTIZ. 1960. Estradiol-17B and progesterone in ovaries of starfish *(Pisaster ochraceus)*. Proc. Soc. Exp. Biol. 103:875-877.

COGNETTI, G. 1954. La proterogonia in una popolazione di *Asterina pancerii* Gasco de Golfo di Napoli. Boll. Zool. 21:77-80.

________ AND R. DELAVAULT. 1962. La sexualite des Asterides. Cahiers de Biol. Mar. 3:157-182.

________ AND R. DELAVAULT. 1960. Recherches sur la sexualite d'*Echinaster seposita* (Echinoderme, Asteride): Etude des glandes genitales chez les animaux des cotes' de Livourne. Cahier Biol. Mar. 1:121-132.

DEHN, P. F. AND G. W. HINSCH. 1981. The ultrastructure of the mature spermatozoan of the primitive platyasterid *Luidia clathrata* (Say) (Echinodermata: Asteroidea). Gamete Research 4:547-553.

DELAVAULT, R. 1960. La sexualite chez *Echinaster sepositus* Gray de Golfe de Naples. Pubbl. Staz. Zool. Napoli 32:41-57.

________. 1966. Sex determinism. Pp 615-638. In: BOOLOOTIAN, R.A. (ed.) Physiology of Echinodermata, Interscience Publ., N.Y.

EMSON, R. H. AND R. G. CRUMP. 1976. Brooding in *Asterina gibbosa*. P. Thal. Yugo. 12: 99-108.

EGAMI,N. 1955. Production of testis ova in adult males of *Oryzias latipes* III. Testis ovum production in starved males *(Oryzias latipes)*. J. Fac. Sci. Univ. Tokyo Zool. 7:421-428.

GONOR, J. J. 1973. Sex ratio and hermaphroditism in Oregon intertidal populations of the echinoid *Strongylocentrotus purpuratus*. Mar. Biol. 19: 278-280.

GRASSLE, J. P. 1984. Speciation in The genus *Capitella* (Polychaeta, Capitellidae). Forts. Zool. 29:293-298.

HINSCH, G. W. AND P. F. DEHN. 1979. Ultrastructural evidence for Sertoli-like cells in the testis of the asteroid *Luidia clathrata* (Echinodermata: Platyasterida) from Tampa Bay. Int. J. Invertebr. Reprod. 1: 179-185.

LAWRENCE, J. M., P. F. DEHN, AND S. A. WATTS. 1986. Annual cycles of the gonads and pyloric caeca of *Luidia clathrata* (Echinodermata: Asteroidea) in Tampa Bay (1971-1985). Fla. Scient. 49(S):14.

MOORE, H. B., T. JUTARE, J. C. BAUER, AND J. A. JONES. 1963a. The biology of *Lytechinus variegatus*. Bull. Mar. Sci. Gulf Caribb. 13:23-53.

________, T. JUTARE, J. A. JONES, B. F. MCPHERSON, AND C.F.E. ROPER. 1963b. A contribution to the biology of *Tripneustes esculentus*. Bull. Mar. Sci. Gulf Caribb. 13: 267-281.

PEARSE, J.S. 1965. Reproductive periodicites in several contrasting populations of *Odontaster validus* Koehler, a common Antarctic asteroid. Biol. Antarctic Seas 5:39-85.

SCHOENMAKER, H. J. N., J. G. LAMBERT, AND P. H. VOOGT. 1976. The steroid synthesizing capacity of the gonads of *Asterias rubens*. Gen. Comp. Endocr. 29:256A.

Florida Sci. 51(1):23-27. 1988.
Accepted: July 17, 1987.

SOCIAL FACTORS, HEALTH KNOWLEDGE, AND HEALTH ATTITUDES: PARTICIPATION IN A CARDIOVASCULAR RISK REVERSAL PROGRAM

Curtis W. Wienker(1) and Travis J. Northcutt, Jr.(2)

(1)Department of Anthropology and (2)Human Resources Institute,
College of Social and Behavioral Sciences, University of South Florida, Tampa, FL 33620

Abstract: *Questionnaires were administered to 25 non-participants, 34 non-adherent participants, and 53 people who completed a cardiovascular risk reversal program. More than one-third of those encouraged to participate did not; another 25 percent did not continue participation in the multi-week program. The questionnaire concerned vital statistics, sociocultural factors, and health knowledge, behaviors, and attitudes. Results suggest that the program was effective. Those exposed to at least half of the program knew vital health and cardiovascular knowledge better than did non-participants. They were also significantly more social, considered themselves in better health, were less fatalistic and more frequent church attendants in comparison to non-participants. The large number of non-participants and non-adherent participants is probably the result of common motivational problems regarding preventive health behavior.*

The Cardiovascular Risk Reversal Center in Delray Beach, Florida utilizes informal group education sessions with an emphasis on nutrition to reduce the possibility of cardiovascular disease among individuals who have been clinically diagnosed as "at risk" by Palm Beach County Health Department. Criteria for "at risk" status include elevated blood pressure, overweight, and biochemical barometers. Participants are ethnically diverse and medically indigent; they must also have at least one metabolic risk factor (Christakis et al., 1976) for cardiovascular disease.

As of March, 1976—the historic present of this study—more than one-third of those encouraged to attend the Center did not and another 25% did not continue to participate in the 4 week sessions, which are conducted by a nurse. At these sessions, clients receive weight and blood pressure readings, as well as blood biochemistries, if they consent. The nurse focuses on 1 risk factor each week, though such preventive health behaviors as exercise are included. Proper nutrition, along the lines of the "Prudent Diet", is the key topic. Clients are taught to limit intake of saturated fats, sugars, salt, and portion size itself. Audio-visual aids are utilized; clients are encouraged to give opinions and ask questions. Food demonstrations are also conducted; most sessions include the serving of samples of low-calorie nutritious foods. Each session features a cogenial non-clinical atmosphere.

Methods—Baseline data were gathered on all 265 participants and eligible non-participants prior to any contact with them. Of the 265 who had been referred to the center by the county health department, 8 (3%) had just begun participation and are not included in this report because of their small number; 99 (37%) had finished or had attended at least 2 of the 4 sessions and were still participating, 65 (25%) had quit the program after 1 session, and 93 (35%) had never participated at all.

Separate structured questionnaires were administered to individuals in each group, in person whenever possible and by telephone if logistical factors precluded a personal interview. These questionnaires ascertained demographic and sociocultural data, health knowledge, attitudes and beliefs, and attitudes and opinions regarding the Center. Closed-ended questions were analyzed using the Statistical Package for the Social Sciences (Nie et al., 1975). The responses of 3 groups (non-adherent participants or dropouts, adherent or finished participants, and non-participants) were compared to determine if participants learned from the Center and which factors influenced participation. Repeated attempts were made to interview everyone who had been referred to the Center. Some 112 questionnaires were returned; the response rate was 42%. The sample included approximately 25% of all non-participants and slightly more than half of all non-adherents and finished participants. A pre-test was administered to 3 people in each group.

RESULTS—A capsule socio-demographic profile of the sample groups is contained in Table 1. The 53 participants who finished the program were primarily black American women, with an 8th grade or less education. Most fell within the 25-44 year age range and were Protestants, but not regular church-goers. Most were unemployed; those who did work were maids or laborers. The majority were married and made between $400 and $599 monthly; however, nearly 25% made less than $200 per month.

The 34 non-adherent participants (dropouts) were primarily female and were divided rather evenly between black and white Americans. Their educational level was less than 8th grade, although more in this group graduated from high school than among the finished participants. Most in this group also fell within the 25-44 year age range. Non-adherent participants were Protestants, but were churchgoers even less frequently than the finished group.

The 25 non-participants were primarily female black Americans. Most of the others in this group were Caribbean, Mexican, or Spanish in ethnicity. Most were less educated than the previous groups, having less than an 8th grade education. Non-participants also fell within the 25-44 year age range. Many more of this group lived in migrant labor camps. The majority were Catholic; although most were not regular churchgoers, they did attend church more frequently than the non-adherent group.

The 3 groups were not significantly different demographically, with regard to sex ($X^2=1.1562$, 2 df, $p>0.50$), race ($X^2=11.6335$, 10 df, $p>0.30$), education ($X^2=5.6917$, 6 df, $p>0.40$), age structure ($X^2=1.7871$, 4 df, $p>0.70$). The sample groups were representative of their respective popula-

TABLE 1. Selected demographic characteristics of the sample groups.

	Non-Participants		Non-Adherents		Finished	
Variable	N	%	N	%	N	%
Males	4	16	9	26	14	26
Blacks	10	41	13	39	31	62
High School education	6	24	9	28	16	30
Age 25-44 yrs	16	64	22	64	29	54
4-6 people in household	11	44	12	36	20	37
Protestants	8	40	16	64	26	70
1 Organization membership	0	00	4	12	11	20
Regular worship	9	36	4	12	20	37

tions with the exception that there were proportionately fewer whites in the non-participant sample than were in that population.

In addition to an analysis of all 3 groups together, the following statistical comparisons were made: non-participants with non-adherents, non-adherents with finished participants, and non-participants with those who finished the program. Respectively, this can be interpreted as non-existent versus minimal participation, minimal versus optimal participation, and non-existent versus optimal participation. The latter comparison should most specifically indicate any benefits of the program.

Generally, the results of this study parallel those of Archer and his associates (1967). Their work, however, focused on the participation of upper class Jewish men, age 40-59 years, in an anti-coronary club. In their research the active-participant group had made much greater investments of time, absolutely and in terms of duration of their active status, than had the Center's finished participants. It is noteworthy and perhaps highly meaningful that the Center's director, George Christakis, M.D., was a member of the research team that studied the anti-coronary club's participant groups.

One interesting and inexplicable finding is that the three groups differ significantly ($X^2 = 9.6219$, 2 df, $p < 0.01$) with regard to a fatalistic attitude. While only 7 of 22 (32%) non-participants and 10 of 48 (21%) finished participants expressed a fatalistic attitude, over half (16 of 29, or 55%) of non-adherent participants did.

When compared with non-participants, finished participants belonged to significantly more organizations ($X^2 = 4.4487$, 1 df, $p < 0.05$) and were significantly more knowledgeable with respect to prudent nutrition, in terms of foods which are beneficial ($X^2 = 10.2097$, 1 df, $p < 0.005$) and detrimental ($X^2 = 18.2387$, 3 df, $p < 0.005$) to cardiovascular health. They also considered themselves in better health ($X^2 = 12.3727$, 2 df, $p < 0.005$) than did non-participants.

Finished participants were significantly more likely to attend religious services ($X^2 = 4.7560$, 1 df, $p < 0.05$) than were non-adherent participants. Other significant differences between those 2 groups were that finished participants considered themselves in better health ($X^2 = 6.6099$, 2 df, $p < 0.05$) and were less fatalistic ($X^2 = 8.0580$, 1 df, $p < 0.005$) than were non-adherents.

When non-adherents were compared with non-participants, the former were significantly more concerned about possibly developing cardiovascular disease ($X^2 = 7.6551$, 2 df, $p < 0.005$). When all 3 groups were compared, significant differences exist with respect to fatalism (noted earlier), perception of one's health ($X^2 = 12.8579$, 4 df, $p < 0.05$), fatalism ($X^2 = 9.6219$, 2 df, $p < 0.05$), prudent nutrition ($X^2 = 15.7359$, 2 df, $p < 0.005$), and cardiovascular disease knowledge ($X^2 = 7.8002$, 2 df, $p < 0.01$).

In addition to the statistically significant differences noted above, there are 10 questions for which a continuum exists across the 3 groups, in terms of best or correct responses. These are listed in Table 2. For 5 questions directly related to cardiovascular disease, of the 3 groups, non-participants had the fewest, and finished participants the most correct responses. The same continuum is manifested in response to 5 questions related to positive health attitudes and behaviors.

Hispanics (approximately 25% of the entire sample) were proportionately overrepresented in the non-participant group and among non-compliant participants. There were proportionately fewer Hispanics in the finished participant group.

TABLE 2. Continua across groups involving correct/best answers regarding health attitudes and behaviors, and cardiovascular disease knowledge.

	Non-Participants		Non-Adherents		Finished	
Question	N	%	N	%	N	%
Do you consider yourself in good health?	8	32	11	35	29	55
Is your ideal weight less than you weigh?	18	72	22	71	27	50
Why do you eat what you eat?	10	60	11	64	16	69
Do you drink more than 3 alcoholic drinks/ week?	20	80	25	80	47	88
Which of these life factors is most important?	6	24	11	34	31	58
How serious is cardiovascular disease?	22	88	29	90	51	96
Which is bad for your heart, if you eat too much of it?	11	52	19	59	47	90
Which food is better for your heart?	17	70	29	93	51	98
How many die each year from stroke/heart disease?	4	19	14	48	26	55
Hypertension is most common in which group?	8	50	10	52	25	61

DISCUSSION—Earlier we noted that 25% of the Center's clients dropped out after the first session, and that 35% never attended any sessions. The former figure is similar to the 27% dropout rate of the Chicago Coronary Preventive Evaluation Program (Wright and Frederickson, 1974: 41). The drop-out rate of the Center compares favorably with the 47% rate of non-adherent participation in the Anti-Coronary Club (Christakis et al., 1966) and the 53% rate encountered in a 5 year program in Portland, Oregon (Hollis et al., 1984). However, each of these programs was conducted with a different target population. Each was also of much greater duration and utilized different kinds of intervention modalities.

Thus the dropout and non-participation rates of the Center, although lower than those of some other programs, are significant problems. That is particularly true of the rate of non-participation, 35%. Indeed, such medically indigent target populations as that of the Risk Reversal Center have been traditionally recognized by health care providers as among those groups least "reachable" with health services. However, by the late 1970s, data indicated that income had a negligible direct effect on utilization of preventive health care services (Rundall and Wheeler, 1979).

The pattern of dropout, non-compliance and adherent participation by Hispanics noted above is not surprising. Martinez and Martin (1966) suggest that Mexican Americans may be less apt to accept an "at risk" state, given their cultural conceptualization of what illness is. In a similar vein, Harrison and co-workers (1978) note that the "at-risk" role may not be readily acceptable to subcultures that are less-future oriented than traditional Anglo-American society.

In addition to ethnicity, certain other characteristics were extracted from the findings that may account, at least in part, for the dropout rate and frequency of non-participation. Both non-participants and non-adherent participants felt less personally responsible toward their own health. The staff of the Center and local health officials felt that the drop-out rate was due to a general lack of motivation toward preventive health care, a factor characteristic of other such programs. Unfinished participants did not list health as a top priority in life as often as finished participants. This is probably compounded by the fact that hypertension and biochemical risk for cardiovascular disease are usually asymptomatic conditions.

Although non-participants were more frequently Catholic, research indicates that neither religious denomination (Comstock and Kay, 1972) nor church attendance (Archer et al., 1967) are statistically related to health or health behavior. However, the Center's finished participants were significantly more regular in church attendance than were dropouts. Non-participants were less likely to belong to organizations, perhaps indicating less social participation. A key variable may be social participation, in that research on polio vaccine acceptance (Northcutt et al., 1964) has demonstrated that the number of social groups to which people belonged was one of the major discriminators between individuals who accepted and those who rejected vaccination. Research on social networks, health beliefs, and preventive health behavior has shown that social group and social-psychological attributes are important in accounting for variation in such important preventive health features as nutrition behavior (Langlie, 1977).

As with dropouts, non-participants were not as likely to list health as a top priority in their lives. The fact that finished participants were less fatalistic corresponds with a finding from the Portland study (Hollis et al., 1984) mentioned earlier. One predictor of participation was a stronger internal locus of health control.

As noted earlier, there were many similarities in the demographic profiles of the finished participants and dropouts. Research focusing on participation in the Stanford Heart Disease Prevention Program (Meyer and Henderson, 1974) concluded that heterogeneity in group composition may provide supports (in terms of successful participation) that are not possible in homogeneous groups.

Knowledge on cardiovascular disease and prudent diet was most prevalent in the finished group, followed by non-adherents; non-participants had the least knowledge. This appears to be a direct result of the program; groups had roughly the same educational level. One plausible reason for the lack of non-participants' knowledge regarding diet may be that more in that group were Spanish-speaking; hence cultural preferences may have been reflected in their responses to questions concerning diet.

CONCLUSIONS—We conclude that the Cardiovascular Risk Reversal Center has achieved success in that participants who have completed at least half of the sessions have greater knowledge concerning cardiovascular disease and its prevention, when compared to those who forego the program or those who discontinue participation in it.

The crucial question becomes one of motivating persons toward greater preventive health behavior without alienating them in the process. One long-range way to influence preventive health behavior is to validate the existence of the "at-risk" role. Baric (1969) emphasizes the differences of the sick role versus the "at-risk" role. The latter does not include the advantages of the former; that is, a person at-risk is not exempt from social responsibilities nor is he or she dependent on other people for getting well. One's expected behavior must be continuous, in that there is no "pay-off" of quick recovery. The "at-risk" role implies fighting off temptation, and being held at least partially accountable for one's condition. Most important, this role is not institutionalized in our society, nor is it accompanied by significant social reinforcements.

In order to remove the burden of the "at-risk" role, health care professionals must participate more actively in legitimizing the "at-risk" condition (Baric, 1969). Preventive health education programs must stress the importance of such meaningful groups as family, friends, colleagues, as well as cultural differences, in accepting and validating the status/role of a person at-risk for significant health problems. This is especially important when risk prevention and reversal programs target on such culturally pluralistic groups as the indigent, inasmuch as illness risk is a culturally defined variable (Harrison et al., 1978).

ACKNOWLEDGMENTS—We are grateful to Dr. Carl Brumbach, Dr. George Christakis, the Palm Beach County Health Department, the staff of the Center, the participants in this research, and to Ms. Karla Wallat for data collection. This research was supported with funds provided by the Florida State University System Board of Regents.

LITERATURE CITED

ARCHER, M., S. RINZLER, AND G. CHRISTAKIS. 1967. Social factors affecting participation in a study of diet and coronary heart disease. J. Health Soc. Behav. 8:22-31.

BARIC, L. 1969. Recognition of the "at-risk" role: a means to influence health behavior. Internat. J. Health Educ. 12:24-34.

CHRISTAKIS, G., R. BAKER, AND C. BRUMBACH. 1976. Risk factor center program. Florida's Health. 68:27-47.

_________, RINZLER, S., M. ARCHER, AND A. KRAUS. 1966. Effect of the anti-coronary club program on coronary heart disease risk-factor status. J. Am. Med. Assoc. 198:129-136.

COMSTOCK, G., AND K. PARTRIDGE. 1972. Church attendance and health. J. Chron. Dis. 25:665-672.

HARRISON, G., M. TYMRAK, AND G. FRIEDMAN. 1978. The Riverside School heart project: a laboratory in applied medical anthropology. In: BAUWENS, E. (ed.), The Anthropology of Health. C. V. Mosby Co., St. Louis, Missouri.

Hollis, J., G. Sexton, S. Conner, L. Calvin, C. Pereira, and J. Matarrazo. 1984. The family heart dietary intervention program: community response and characteristics of joining and nonjoining families. Prev. Med. 13:276-285.

Langlie, J. 1977. Social networks, health beliefs, and preventive health behavior. J. Health Soc. Behav. 18:244-259.

Martinez, C., and H. Martin. 1966. Folk diseases among urban Mexican-Americans. J. Am. Med. Assn. 196:161-164.

Meyer, A., and J. Henderson. 1974. Multiple risk factor reduction in the prevention of cardiovascular disease. Prev. Med. 3:225-236.

Nie, N., C. Hull, J. Jenkins, K. Steinbrenner, and D. Bent. 1975. SPSS: Statistical Package for the Social Sciences. 2nd ed., McGraw-Hill, New York, New York.

Northcutt, T., C. Jenkins, and A. Johnson. 1964. Factors influencing vaccine acceptance. Pp. 31-56. In: Neill, J. and J. Bond (eds.). Hillsborough County Oral Polio Vaccine Program. Florida State Board of Health, Jacksonville, Florida.

Rundall, T., and J. Wheeler. 1979. The effect of income on use of preventive care: an evaluation of alternative explanations. J. Health and Soc. Behav. 20:397-406.

Wright, I., and D. Fredrickson (eds.). 1974. Cardiovascular Diseases: Guidelines for Prevention and Care. The Inter-Society Commission for Heart Disease Resources. Department of Health, Education, and Welfare, Washington, D.C.

Florida Sci. 51(1):28-34. 1988.
Accepted: July 29, 1987.

ADOPTION-RELATED COUNSELING SERVICES IN THE TAMPA BAY AREA: A NEEDS ASSESSMENT

MARIE-ANNE G. JOHNSON

Department of Anthropology, University of South Florida, Tampa, FL 33620

ABSTRACT: *More children previously thought unadoptable are being adopted. "Special needs" children can be successfully placed, but the process requires careful guidance. Twelve key informants were interviewed to produce information on adoption agencies in the Tampa Bay area. Questionnaires were administered to 132 providers and consumers of adoption counseling services, including foster, prospective and adoptive parents, adoptees, and various professional support personnel. The questionnaire concerned vital statistics, rating and ranking of counseling services, assessment of need for expanding existing services or creating new ones, and comments. Findings suggest that there is a need for expansion of counseling services. Shortages of staff, time, and funds place limitations on the amount and quality of counseling services provided.*

ADOPTION involves becoming a parent through a legal and social process rather than through a biological one. The ancient practice, described in the writings of the Egyptians, the Babylonians, the Greeks, and the Romans, almost completely disappeared until the early nineteenth century, when it was reinstated in Europe (Kadushin, 1980). In the United States, orphan asylums used indenture as one of the main forms of placing children until the Civil War. The first adoption law was passed by the State of Massachusetts in 1851 (Rihs, 1976).

Throughout history people have adopted children for various reasons: to provide heirs, to guarantee ancestral worship and perpetuation of a family name, to provide cheap labor, and as a form of population and cultural control (Melone, 1976; Rihs, 1976; French, 1980; Kadushin, 1980). Recent studies have found a relationship between motives and placement outcome (Klomineck, 1976; Kraus, 1978).

The civil rights movement of the 1960s has brought a renewed awareness of children's rights and contributed to many changes in adoption practices. Notably, there has been a shift in emphasis from adopting to fulfill the needs of the adopting adults, to fulfilling the needs of the child (Dukette, 1984).

As open records became a requirement in many institutions the practice also gained ground in the field of adoption. The gradual opening of the records and the adoptees' expressed right to know their biological roots led the way to a new practice called 'open adoption', in which some degree of relationship is kept between biological parents, the child, and adoptive parents (Dukette, 1984).

Influenced by changes in American family life, adoption agencies have also begun placing children in single-parent homes (Feigelman and Silverman, 1977).

The language used by professionals is evolving as well. For example, the terms 'natural' and 'real' mother suggested that the adoptive mother may be 'unnatural' or 'unreal'. The recently preferred terminology avoids the negative connotation by using the words 'biomother' or 'birth mother' instead (Kadushin, 1980).

A majority of prospective adoptive parents would prefer to adopt healthy infants. However the problem is that adoptable infants have become increasingly rare in the United States, due in part to the following factors: (1) an ambivalent view of children has lowered our birth rate (2) illegitimate fetuses are increasingly aborted (3) or such babies are kept by their mothers. Therefore, in the past twenty years many adoptive couples have adopted children from other cultures, while others have turned to a category of children considered 'hard-to-place' or 'special needs' children (De Hoyos et al, 1983). According to the Department of Health and Rehabilitative Services, a special needs child is eight years old or older; has mental, physical, or emotional handicaps; is part of a sibling group; is bi-racial or part of a minority group.

This change in adoption pattern from white infants to older, handicapped, and minority children has created a different set of needs to be met for all parties involved, and, according to adoption experts, counseling can alleviate some of the transitional stress and long-term problems, and can make the difference between permanent placement and disruption. Adoption disruption refers to the removal of a child from the adoptive home at any time during placement and legal adoption (Zwimpfer, 1983). Disruption rates of white infants placed for adoption have been estimated to approximate 1%, while the disruption rate for special needs adoptions ranges between 6% and 19% (Welch, 1983).

Of particular concern is the state of mental health of those involved in the adoptive process. "Adoption outcome studies comparing adoptive and non-adoptive families have shown that adoptive children are more likely to seek psychiatric treatment" (Schecter 1969, in Welch, 1983:12).

A 1982 assessment of adoption services for children in foster care conducted by the Florida Mental Health Institute in Tampa states that the major reasons for disruptions were: (1) poor training and support for the adoptive parents (2) a poor matching of child with parents (3) an inadequately short follow-up period (Welch, 1983). An anthropological investigation of the Hillsborough County Foster Care System concluded that that system was essentially dysfunctional and harmful (Jacoby, 1977).

STUDY GOALS—This study on adoptive counseling services in the Tampa Bay area was conducted in the Spring of 1985 for the Suncoast Mental Health Associates, a team of counselors who were looking to expand their services, possibly in the field of adoption.

In the context of this study, the word 'counseling' was defined rather broadly to include formal counseling as well as information, education, support, and assessment of personal and family needs. I would have liked to survey all groups involved in the process since each plays an important role in the successful or non-successful placement of a child, although at various times and in various degrees. Time constraints, the sensitive nature of the topic, and the fact that agencies would not release the names of their clients ruled out surveying biological parents, for both interviews and questionnaire. It also proved difficult to secure names of such professionals as physicians and attorneys, the only ones who can legally act as intermediaries in independent adoptions.

The goals of the needs assessment were: (1) to identify agencies dealing with adoption in the Tampa Bay area, and briefly describe the services they provide (Johnson, 1986); (2) to determine which services are perceived as most important, which should be expanded, and which need establishing; (3) to offer recommendations to the professional mental health counselor.

METHODS—(1) six adoptions agencies were identified in Hillsborough and Pinellas Counties and potential informants were contacted in these agencies; (2) twelve key informants were interviewed to obtain information about community needs and utilization patterns. Key informants included administrators, directors, supervisors, and social workers from adoption agencies and centers for pregnant teens; a clinical social worker who counsels adoptees in her private practice; and an adoptive parent who established and leads the Tampa Adoption Support Group. These interviews were recorded and later transcribed; (3) group meetings were observed: two foster parent association meetings; one agency adoptive parent orientation meeting; and two meetings of the Tampa Adoption Support Group; (4) a survey questionnaire based on key informant interviews was administered. The questionnaire consisted of eighteen questions dealing with: ranking and rating of various services (these are listed in table 1.), and which need expanding; need for group counseling and training; specific information about each group surveyed (Johnson, 1986); and two questions allowing for open-ended responses about services provided or lack of such serivices, and suggestions of which might have been helpful. The questionnaires were mailed or distributed to 132 persons in Hillsborough and Pinellas Counties. Seventy-five were completed and returned, or 57% of the questionnaire population. The highest response rate (87%) came from the professional support personnel or service providers category; the lowest (26%) from the foster parent category.

RESULTS—According to questionnaire respondents, the most important counseling services center on the biological parents and on the preparation of the adoptive family. Responses to the question "Which services would you choose to expand? Please check 5" are shown in Table 1.

A comparative analysis of the most selected and the least selected services by category of respondents was made using a chi-square test. The differences are not statistically significant, indicating that the respondents agree rather than disagree on which services need expansion.

Asked if there was a need for more group training and counseling, 56% of the respondents answered 'yes'. Foster and adoptive parents were then grouped in one category, service providers in another, to test differences in these groups' answers. Again a chi-square test showed no significant difference between parents and professional staff. Both see a need for more group techniques in adoption training and counseling.

Of the professionals surveyed, 27 had worked in the field of adoption for an average of 8.5 years, ranging between one week and 40 years, with a bimodal distribution of 2 and 6 years (standard deviation: 8.58). At least two

TABLE 1. Services needing expansion, by number of times chosen.

N = 71

Services	Times chosen	Percent
Adoptive parent counseling	47	66
Biological parents counseling	41	57
Adoptive child transition counseling	35	49
Adoptive parents supportive counseling during the transition	31	44
Foster parents training and supportive counseling	30	42
Adoptive parents supportive counseling after adoption	30	42
Adoptive child pre-adoptive counseling	28	39
Long-term supportive counseling for the adoptive family	21	30
Social worker supportive counseling	19	27
Other (specify which)	18	25
Opportunity for biological and adoptive parents to meet	13	18

of these service providers had been adopted, but they did not answer the 'adoptee' questions in the questionnaire.

DISCUSSION—The combined findings of interviews, questionnaire responses, comments and suggestions support those found in the literature, which are that counseling services are or should be an important component of the adoptive process. Recent developments in adoption practices—increase in special needs adoptions, single parent adoptions, and open adoption—have made the need for counseling even greater.

Many of the adoptive parents surveyed wished for more contact with agency staff, more group meetings for both husbands and wives on adoptive parenthood and shared responsibilities, particularly during the long waiting period. Several adoptive parents mentioned the Tampa Adoption Support Group as an important source of support and education before and after receiving their child.

HRS workers advocate complete family counseling for special needs adoption since each member is affected and affects the placement. In practice, according to an informant, the emphasis is on the child, and seldom includes the whole family. Sixty percent of the key informants have stated that shortages of staff, time, and funds, place limitations on the amount and quality of counseling services provided.

Lack of funds or mismanagement of available funds constitute a serious problem in many states. According to the chairman of the House Select Committee on Children, Youth and Families, "The problem is deeply rooted, and the failure of federal and state officials to enforce existing laws governing foster care results in nothing less than state-sponsored child abuse. The solution lies not in passing new laws but in enforcing and adequately financing the law already on the books" (Miller, 1987).

As a group, foster parents are of lower socio-economic and educational level than the majority of adoptive parents, yet they receive minimal training to deal with sometimes very difficult psychological and medical cases. Foster parents indicated that they do need more training and counseling, more information on the birth parents, more contact with case workers and adoptive parents, preparation for the separation from their foster children, and generally more support from the placing agencies and the whole community.

Adoptees stressed the importance of learning of their adoptive status early and from the adoptive parents themselves; the need to find out about biological parents; problems brought on by younger siblings born into the adoptive family; frustrations of not knowing one's own medical history; and cultural adjustment difficulties encountered by foreign-born adoptees, particularly in the school system.

Openness should relieve much anxiety on the part of both birth mothers and adoptees. Some adoptive parents welcome the change, but many are still reluctant to meet the biological mother or the foster families. At the time of this study none of the agencies surveyed was practicing completely 'open' adoption, but several administrators and their staffs feel that it will gradually be implemented. This implementation will require specialized professional guidance to all involved, including the staff.

In this study the typical adoption and foster worker is a white female between the ages of thirty and forty. She is faced with demanding, often crisis-type work, may be undertrained, receives low pay and little recognition for her work (Russell and Silberman, 1979; Ward, 1979). In areas such as Child Protection Services, turnover among case workers ranged from 35% to 50% statewide; in South Florida, it often reaches 80% (*St. Petersburg Times*, 1986). These are far from ideal conditions for the recruitment, training and support of foster and adoptive families. Service providers agree that there is a need for private counselors who understand the dynamics of adoption.

RECOMMENDATIONS—All areas of adoption services offer opportunities for the mental health counselor—biological parents, foster care, special needs children, and adoptive families. Among the many specific services that they could provide the following were suggested by informants and questionnaire respondents: (1) providing group therapy for those children who have been sexually abused; (2) training social workers in planning for foster care; (3) counseling to pregnant teens in school settings or in specialized agencies; (4) screening of adoptive parents in cases of independent adoption; (5) providing guidance and support in establishing support groups for special needs adoptions; (6) organizing meetings between foster and adoptive parents during the transitional stage; (7) guidance in conducting birth mother support groups; (8) counseling to parents who adopt bi-racial or foreign-born children, on an individual basis or in the form of classes or seminars; (9) conducting home studies of foster and adoptive families for agencies or individuals; (10) counseling for adoptees who want to search for and find their biological parents; (11) educating the public about adoption.

The adoption field needs the expertise of many specialists who will find challenges and rewards in making a difference in the lives of many, particularly those of children who are still awaiting a family of their own, and the families who will adopt them.

LITERATURE CITED

De Hoyos, G., A. De Hoyos, and C. Anderson. 1983. Adoption differentials in three cultural settings. Internat. Child Welfare Rev. 57:35-44.

Dukette, R. 1984. Value issues in present-day adoption. Child Welfare. 63:3:233-242.

Feigelman, W. and A. Silverman. 1977. Single Parent Adoptions. Soc. Casework. 77:418-425.

French, L. 1980. An analysis of government sterilization and adoption practices involving native americans. Internat. Child Welfare Rev. 45:37-40.

Jacoby, T. 1977. An anthropological investigation of a dysfunctional social service system: Foster Care in Hillsborough County, Florida. Masters Thesis, Univ. South Florida, Tampa.

Johnson, M.-A. 1986. Adoption related counseling services in the Tampa Bay area. Masters thesis. Univ. South Florida. Tampa.

Kadushin, A. 1980. Substitute Care: Adoption. in Child Welfare Services, ed. 3. Macmillan., New York.

Klomineck, W. 1976. The development of adoptive children in their new family environment. Internat. Child Welfare Rev. 28:43-51.

Kraus, J. 1978. Family Structures as a Factor in the Adjustment of Adopted Children. Brit. J. Soc. Work. 8:327-337.

Melone, T. 1976. Adoption and crisis in the Third World: thoughts on the future. Internat. Child Welfare Rev. 29:20-25.

Miller, G. 1987. Neglect of Foster Care is Shameful. St. Petersburg Times: March 25, 1987.

Rihs, C. 1976. Adoption and the law: present situation and new trends. Internat. Child Welfare Rev. 28:52-58.

Russell, T. and J. Silberman. 1979. Improving the delivery of specialized foster care services. Soc. Casework. 79:402-407.

St. Petersburg Times. 1986. Caseworker turnover hurts child services. Editorial. December 2, 1986:8B.

Ward, M. 1979. The relationship between parents and caseworker in adoption. Soc. Casework. 79:96-103.

Welch, J. 1983. Adoption disruption of children with special needs: an exploration of variables. Masters Thesis, Univ. South Florida, Tampa.

Zwimpfer, D. 1983. Indicators of adoption breakdown. Soc. Casework. 83:169-177.

Florida Sci. 51(1):35-40. 1988.
Accepted: August 19, 1987.

VITAMIN C AND DENTAL HEALING

ROBERT A. HALBERSTEIN(1) AND GLENN M. ABRAHMSOHN(2)

(1)Department of Anthropology, Department of Epidemiology & Public Health,
University of Miami, Coral Gables, FL 33124, and
(2)International Institute of Nutrition and Stress, Key Biscayne, FL 33149

ABSTRACT: *The potential therapeutic value of ascorbic acid in facilitating the recovery from oral surgery is investigated through the computerized statistical analysis of clinical and demographic data on 452 consecutive tooth extraction patients who visited a dental clinic in Miami, Florida. The 277 patients who were prescribed vitamin C post-surgically exhibited significantly more rapid healing than the 175 control subjects who received none. The incidence of alveolalgia ("dry socket"), a painful and troublesome extraction complication, was over five times lower in the sub-sample receiving vitamin C. Age, sex, occupation and health history were not statistically correlated with healing rates. Recent research indicates that ascorbic acid might enhance dental healing by stimulating the immune system and hastening the proper formation of scar tissue.*

THE search for natural healing substances by mankind was launched in prehistoric times. The successful utilization of medicinal plants and curative animal products, for example, is an ancient practice according to archeological evidence (Adovasio and Fry, 1976; Grossinger, 1983; Ortiz de Montellano, 1975; Sharon and Donnan, 1977). In recent years increased experimentation with natural organic materials in various societies has resulted in the discovery of innumerable healing substances ranging from analgesics to abortifacients to vitamins and other nutritional supplements (Aikman, 1977; Anderson, 1977; Griggs, 1981; Halberstein, 1983; Lewis and Lewis, 1977; Morton, 1977).

Vitamin C, or ascorbic acid ($C_6H_8O_6$), is a white crystalline carbohydrate found in citrus fruits, green vegetables, potatoes, and other foods. It has been tested for many years as a possible healing agent. Pioneering work by Bourne (1949) suggested that dietary supplementation of ascorbic acid was statistically correlated with infection reduction in hospital patients. Hence it has been prescribed and recommended for the treatment of a diverse variety of conditions including the common cold and other viral and bacterial infections (Hughes, 1981, p. 22-25; Lewin, 1974, 1976; Pauling, 1970, 1974; Shilotri and Bhat, 1978; Thomas and Holt, 1978), cancer (Cameron and Campbell, 1974; Cameron and Pauling, 1979; Cameron et al., 1979; Newbold, 1979), and physical injuries (Barnes, 1975; Hunt and Van Winkle, 1976, p. 20; Levenson et al., 1977, p. 29; Stone, 1972).

The administration of vitamin C is controversial, however, for three basic reasons: (1) contrary findings have also been reported (e.g., Creagan et al., 1979; Davies et al., 1979; Dykes and Meier, 1975; Siegel, 1977); (2) harmful side effects may be associated with ascorbic acid "megadoses" (e.g., Baird et al., 1979; Schrauzer and Rhead, 1973; Birch and Parker, 1974); and (3) the optimal daily requirement of the vitamin is not well established (e.g., Briggs, 1984; Harper, 1975). Sauberlich (1975) estimates that healthy adults maintain an average body pool of 1.5 gm of ascorbic acid and that scurvy may be diagnosed when the pool falls below 300 mg. In reviewing recent published sources, Ginter (1982) found daily intake recommendations (RDA) for ascorbic acid varying from 30 mg to 10,000 mg.

Despite the frequently observed occurrence of gingivitis and other forms of dental inflammation in vitamin C deficiency disease (e.g., Chope and Breslow, 1956; Fullmer et al., 1961; Krehl, 1976, p. 69), research has not been conducted on the possible role of vitamin C supplementation in the enhancement of dental healing. A review of the available literature on periodontal disease by Ismail et al. (1983) revealed a lack of standardization in the few inconclusive investigations already carried out, prompting the authors to state, "Only a weak association between periodontal disease and ascorbic acid deficiency has been shown in the analysis of nutritional and periodontal health data" (p. 931).

The purpose of the present study is to test the hypothesis that vitamin C may be effective in promoting dental healing and reducing post-surgical complications of tooth extractions.

Methods—The 452 subjects are consecutive tooth extraction patients who visited a dental/oral surgery clinic in Miami, Florida. Prior to the operations the subjects completed a written questionnaire regarding age, sex, occupation, residence, marital status, previous medical care, past and current prescription medications, and allergies. The data were compiled and statistically treated with SPSS (Nie et al., 1975) and BMDP (Dixon, 1979) computer programs. Cross-tabulations of the variables and a variety of tests of significance including chi-square and analysis of variance were performed. Dental X-rays were taken before each extraction and during follow-up visits.

All extractions were performed by G.M.A., who utilized the standard 5-step elevation technique described by Howe (1971, 1974). Impacted molars were removed with the method developed by Killey and Kay (1975). A local anesthetic—lidocaine hydrochloride 2% with epinephrine 1:100,000—was administered, except for those patients reporting cardiovascular disease histories who received Mepivacaine hydrochloride 2% with Levonordefrin 1:20,000.

Teeth were removed with Healthco #301 and #302 straight elevators and Hufriedy #150, #MD-3, and #MD-4 forceps. All sockets were irrigated with a 0.9% saline solution and curetted with Lucas #86 curets. Bone removal was accomplished with a Midwest #557 long shank surgical burr. The burr was cooled independently of the handpiece with a 0.9% saline solution. Wounds were closed with black silk sutures. The extracted teeth were mainly molars (72%), especially third molars, and premolars removed as part of orthodontic surgery in younger patients. No orthognathic cases, i.e., involving jaw or facial reconstruction, were encountered in the study.

Each patient was provided a printed list of standardized instructions and procedures for post-surgical dental care and dietary modification which is routinely given to all clinic extraction patients. A semi-liquid diet (e.g., soup, pudding, yogurt, cottage cheese, applesauce, etc.) was recommended. Either Tylenol III, Darvon N-100, or Demerol 50 mg was prescribed for pain.

A one-gram/day dosage of vitamin C (500 mg twice daily with meals) was provided for a randomly selected (post-surgically) sub-sample of 237 individuals. A smaller group ($n = 40$) was prescribed 500 mg/day (250 mg twice daily) while 175 received no vitamin C. A second phase of the study, currently underway, involves a "double-blind" experiment with placebos. The vitamin C used in the study was Jefferson-Ward brand (Mobil Corp.). To insure maximum compliance, patients were given the vitamin C prior to leaving the clinic and were telephoned several times in the days following surgery.

All patients were requested to return exactly one week after the operation for suture removal and follow-up evaluation. Each subject was reinterviewed regarding pain, medication side effects, diet, and other aspects of the post-surgical experience. Surprisingly all patients reported the ability to ingest sufficient quantities of recommended liquid and semi-liquid foods. None of the 452 patients reported the usual side effects of vitamin C overdose, such as diarrhea and other forms of gastro-intestinal disturbance (e.g., Schrauzer and Rhead, 1973).

Healing rates and post-surgical complications were monitored and scored. A threefold classification of dental healing progress was employed, based upon criteria suggested by Dubois and co-workers (1982):

Type 1—*Deficient/Infectious healing:* expression of pain and request for additional analgesic; pronounced edema; copious purulent material accompanied by cellulitis and abscess formation requiring incision and drainage; non-existent to weak granulation bed formation; extended antibiotic therapy (erythromycin and/or penicillin).

Type 2—*Slow healing:* expression of pain but with or without need of analgesic; slight to moderate edema; minimal purulent material that could be controlled by patient at home by irrigation with saline mouthwash; moderate granulation bed formation; prophylactic antibiotic therapy (erythromycin and/or penicillin).

Type 3—*Rapid healing:* no expression of pain; no edema or other swelling; no clinically evident infection (e.g., no purulent material); complete granulation bed formation; no analgesic or antibiotic medications.

The incidence of alveolagia, an extremely painful form of faulty post-extraction healing (Archer, 1975, p. 1627), was recorded for all subjects as an objective measure of recovery complication.

TABLE 1. Age-sex composition of the sample.

Age Group	Male	Female	Total
10-19	26	24	50
20-39	103	127	230
40-59	50	51	101
60-79	40	31	71
Total	219	233	452

RESULTS—The age-sex composition of the sample is presented in Table 1. The 219 males and 233 females range in age from 11 to 77 years, and half of the subjects are young adults (20-39). The following occupations were reported (N = 437): labor—42.3%, professional or self-employed—17.6%, student—8.7%, supervisory or managerial—5.0%, and unemployed (including retirees and domestic engineers)—26.3%. Nearly all patients (93.2%) listed residences located in the same quadrant of the city as the clinic. Over a quarter of the respondents (26.6%) had previously been under the care of a physician for such conditions as cardiovascular disease, cancer, injuries, diabetes, and infectious diseases; 18.3% reported allergies to various foods and drugs.

Healing progress was cross-tabulated with vitamin C dosage in Table 2. Subjects receiving vitamin C exhibited more rapid healing, and the differ-

TABLE 2. Healing progress according to vitamin C dosage in the present sample.*

Dosage		Deficient, %	Slow, %	Rapid, %
No vitamin C	(N = 175)	4.0	32.0	64.0
500 mg/day	(N = 40)	0.0	10.0	90.0
1000 mg/day	(N = 237)	2.5	11.4	86.1
	(N = 452)	2.9	19.2	77.9

*Age ($p < .62$) and gender ($p < .57$) differences in healing rates were not statistically significant according to X^2 and analysis of variance.

ences were statistically significant ($p < .01$) according to a chi-square value of 33.3 with 4 degrees of freedom. Gender, age and socioeconomic (occupational) differences in healing progress categories were not statistically significant (see Table 2). While allergies and particular past diseases were not correlated with healing progress, previous care of a physician is associated with slower recovery in the present sample in two respects—(1) more than twice the frequency of category 1 ("deficient/infectious") healings and (2) 10% fewer category 3 ("rapid") healings than patients reporting no previous medical care ($X^2 = 6.1$, 2df, $p < .05$).

TABLE 3. Incidence of alveolalgia (dry socket) according to vitamin C status in the present sample.

Vitamin C Status	Sample Number	Incidence of Dry Socket
Patients without vitamin C	175	5.7%
Patients with vitamin C	277	1.1%
Total	452	2.9%

The incidence of alveolalgia, cross-tabulated by vitamin C status, is presented in Table 3. Dry socket is over five times more common in the subsample not receiving vitamin C ($X^2 = 21.3$, $p < .01$). Archer (1975, p. 1628) estimates an overall dry socket occurrence rate of 3-5% in dental extraction patients.

Among the present alveolalgia patients (N = 13) 23.1% were classified as category 1 healings ("deficient/infectious"), while the remainder were category 2 ("slow"). Four of these subjects served as their own controls in a test of the therapeutic value of vitamin C. Following the one week post-extraction evaluation period, three dry socket patients who previously had not received vitamin C were prescribed a 3,000 mg/day dosage, and one such patient already receiving 1,000 mg/day was boosted to 3,000 mg/day. In each of the four cases alveolalgia symptoms improved dramatically within 48 hours and completely disappeared within 72-96 hours.

DISCUSSION—The present findings suggest that vitamin C is potentially effective in aiding the recovery from dental extractions. In the present sample, supplementary ascorbic acid intake was statistically associated with more rapid clinical healing and reduced likelihood of post-surgical complication. These results are especially significant in light of the discovery that the patients' age, sex, occupation, and past diseases were not statistically correlated with healing rates.

An especially important outcome of the vitamin C administration is the lower incidence of alveolalgia, a painful and troublesome dental extraction complication that is generally due to the improper formation of a granulation bed and subsequent inflammation and possible bacterial infection of the open socket (Archer, 1975, p. 1628). In normal dental healing the granulation bed is a type of scar tissue comprised of active blood vessels (capillary "buds"), clotted blood fibrin, collagen, mucopolysaccharide ground substance (MPGS), and white blood cells. The key diagnostic indicator of dry socket is sharp, excruciating pain localized to the socket which may be delayed in onset and may persist as long as three weeks following the surgery. X-rays may confirm the diagnosis by ruling out jaw damage or sequestra (fragments of necrotic bone in the socket).

A review of recent research on ascorbic acid reveals that it may enhance dental healing through a combination of different mechanisms. One possible avenue is stimulation of the immune system. A number of investigations have demonstrated that ascorbic acid accelerates the formation of antibodies and increases their antimicrobial action (Banic, 1975; Hughes, 1981, p. 25; Lewin, 1974). Vitamin C supplementation is associated with elevated white blood cell activity (Thomas and Holt, 1978) and the stepped-up production of the leukocyte enzyme hexose monophosphate which impairs bacterial development (Shilotri and Bhat, 1978). In addition, ascorbic acid acts as a reducing agent in the metabolic conversion of oxygen to superoxide, another proven antibacterial substance in the white blood cells (Levenson et al., 1977, p. 29). Pearson and Shaw (1982, pp. 88-89) point out that vitamin C increases the manufacture of white blood cell interferon, which possesses antibacterial and other chemotherapeutic qualities. Lymphocyte functions are also reportedly stimulated by vitamin C (Anderson, 1980).

Another possible advantage of vitamin C in dental healing is its assistance in wound repair through the construction of "scar" (connective) tissue. Ascorbic acid is required as a catalyst for the synthesis of collagen, a complex protein which is the principal constituent of connective tissue and tooth socket granulation beds (Hunt and Van Winkle, 1976, p. 19; Levenson et al., 1977, p. 30). Barnes (1975, p. 264) makes the following statement: "Direct involvement of ascorbic acid in collagen synthesis is well known and represents the most clearly defined biochemical role of the vitamin." Ascorbic acid participates in the hydroxylation of the amino acids proline ($C_5H_9O_2N$) and lysine ($C_6H_{14}N_2O_2$) to form hydroxyproline and hydroxylysine. The modified amino acids are almost unique to collagen, and they serve to maintain large quantities of collagen during the growth and development of scar tissue in wounds and fractures (Barnes, 1975; Ginter, 1982; Hunt and Van Winkle, 1976, pp. 19-20). The role of vitamin C in this process is succinctly summarized by Krehl (1976, p. 21): "A key nutrient in the synthesis of collagen, ascorbic acid has been identified in the reaction by which proline is hydroxylated to form hydroxyproline, a key component of collagen." Proline and hydroxyproline together account for approximately 32% of the amino acid composition of collagen. A recent experiment by Rokosova and Chvapil (1974) indicates that the production of hydroxyproline increases linearly in direct proportion to vitamin C intake in human subjects.

Three additional reported biochemical effects of ascorbic acid may help promote oral wound management: (1) increase in iron absorption from food (Cook and Monsen, 1977); (2) strengthening of blood clots (Pearson and

Shaw, 1982, p. 415); and (3) reduced probability of red blood cell hemolysis (Barnes, 1975).

The present findings regarding alveolalgia indicate that vitamin C might also reduce the likelihood of dry socket and other post-surgical complications in dental extraction patients. Treatment for dry socket is primarily palliative, but typically the strongest analgesic preparations cannot completely eliminate the pain. Eugenol and zinc oxide (combined to form a paste) have proven successful to a limited degree (Archer, 1975, p. 1630). It is noteworthy from an anthropological standpoint that eugenol ($C_{10}H_{12}O_2$), a colorless aromatic oil, is a principal bioactive ingredient of a number of medicinal plants used for thousands of years by people of diverse cultures for cleaning and anesthetizing teeth (Elvin-Lewis, 1983).

The discovery in the present sample that: (1) the incidence of dry socket is significantly lower with the administration of vitamin C (Table 3), and that (2) alveolalgia patients exhibit faster recovery with supplemental ascorbic acid warrants the consideration of vitamin C as a potential treatment for this painful and clinically difficult condition. Since no adverse side effects were found either in the present study or in a recent investigation involving 10 gm/day intake of vitamin C (Moertel et al., 1985), carefully pre-tested higher dosages ("megadose therapy") might be beneficially applied in alveolalgia cases.

Additional investigations on vitamin C are recommended in dental healing for two basic reasons: (1) nearly everyone faces the inevitability of tooth extraction, and (2) vitamin C is a relatively safe and inexpensive over-the-counter product. Further research is also required in order to determine whether ascorbic acid might similarly be of value in hastening the proper recovery from other oral surgery procedures and the treatment of infections.

Acknowledgment—The technical assistance of Suzanne Fregeolle is gratefully acknowledged.

LITERATURE CITED

Adovasio, J. M., and G. F. Fry. 1976. Prehistoric psychotropic drug use in northeastern Mexico and Trans-Pecos Texas. Econ. Bot. 30:94-96.

Aikman, L. 1977. Nature's Healing Arts: From Folk Medicines to Modern Drugs. National Geographic Society, Washington, D.C.

Anderson, R. 1980. The effects of increasing weekly doses of ascorbate on certain cellular and humeral immune functions in normal volunteers. Am. J. Clin. Nutr. 33:71-76.

Archer, W. H. 1975. Oral and Maxillofacial Surgery: vol. II (5th ed.). Saunders. Philadelphia.

Baird, I. M., R. E. Hughes, H. K. Wilson, J. E. W. Davies, and A. N. Howard. 1979. The effects of ascorbic acid and flavonoids on the occurrence of symptoms normally associated with the common cold. Am. J. Clin. Nutr. 32:1691-1698.

Banic, S. 1975. Prevention of rabies with vitamin C. Nature. 258:153-154.

Barnes, M. J. 1975. Function of ascorbic acid in collagen metabolism. Ann. N. Y. Acad. Sci. 258:264-278.

Birch, G. G., and K. J. Parker. 1974. Vitamin C. Applied Science Publishers. London.

Bourne, G. H. 1949. Vitamin C and immunity. Brit. J. Nutr. 2:341-346.

Briggs, M. H. 1984. Recent Vitamin Research. CRC Press. Boca Raton, Florida.

CAMERON, E., AND A. CAMPBELL. 1974. The orthomolecular treatment of cancer. II. Clinical trial of high dose ascorbic acid supplements in advanced human cancer. Chem. Biol. Interact. 9:285-315.

________ AND L. PAULING. 1979. Cancer and Vitamin C. W. W. Norton & Co. New York.

________, L. PAULING, AND B. LEIBOVITZ. 1979. Ascorbic acid and cancer: a review. Cancer Research. 39:633-681.

CHOPE, H., AND L. BRESLOW. 1956. Nutritional status of the aging. Am. J. Pub. Health. 46:61-67.

COOK, J. D., AND E. R. MONSEN. 1977. Vitamin C, the common cold, and iron absorption in man. Am. J. Clin. Nutr. 30:235-241.

CREAGAN, E., C. MOERTEL, AND J. O'FALLON. 1979. Failure of high-dose vitamin C (ascorbic acid) therapy to benefit patients with advanced cancer: a controlled trial. New Engl. J. Med. 301:687-690.

DAVIES, J. E. W., R. E. HUGHES, S. E. REED, AND D. TYRRELL. 1979. Metabolism of ascorbic acid (vitamin C) in subjects infected with common cold viruses. Biochem. Med. 21:78-85.

DIXON, W. J., AND M. B. BROWN. 1979. BMDP: Biomedical Computer Programs. (2nd edition). Univ. Calif. Press. Berkeley.

DUBOIS, D., M. PIZER, AND R. CHINNIS. 1982. Comparison of primary and secondary closure techniques after removal of impacted third molars. J. Oral Maxill. Surg. 40:631-634.

DYKES, M. H. M., AND P. MEIER. 1975. Ascorbic acid and the common cold: evaluation of its efficacy and toxicity. J. Am. Med. Assn. 231:1073-1079.

ELVIN-LEWIS, M. 1983. The antibiotic and healing potential of plants used for teeth cleaning. Pp. 201-220. In: ROMANUCCI-ROSS, L., D. E. MOERMAN, AND L. R. TANCREDI (eds.), The Anthropology of Medicine. Praeger. New York.

FULLMER, H. M., G. R. MARTIN, AND J. J. BURNS. 1961. Role of ascorbic acid in the formation and maintenance of dental structures. Ann. N. Y. Acad. Sci. 92:286-294.

GINTER, E. 1982. Optimum intake of vitamin C for the human organism. Nutr. Health. 1:66-77.

GRIGGS, B. 1981. Green Pharmacy: a History of Herbal Medicine. Viking Press. New York.

GROSSINGER, R. 1983. Planet Medicine: From Stone Age Shamanism to Post-industrial Healing. Shambhala Publications. Boulder, Colorado.

HALBERSTEIN, R. A. 1983. The use of medicinal plants to control high blood pressure in the Caribbean. Florida Anthrop. 36:167-177.

HARPER, A. E. 1975. The recommended dietary allowance for ascorbic acid. Ann. N. Y. Acad. Sci. 258:491-497.

HOWE, G. L. 1971. Minor Oral Surgery. (2nd edition). Williams and Wilkins. Baltimore.

________. 1974. The Extraction of Teeth. (2nd edition). Wright. Bristol, England.

HUGHES, R. E. 1981. Vitamin C: Some Current Problems. British Nutrition Foundation. London.

HUNT, T. K., AND W. VAN WINKLE. 1976. Fundamentals of Wound Management in Surgery—Wound Healing: Normal Repair. Chirurgecom Publ. Inc. South Plainfield, N. J.

ISMAIL, A., B. BURT, AND S. EKLUND. 1983. Relation between ascorbic acid intake and periodontal disease in the United States. J. Am. Dent. Assn. 107:927-931.

KILLEY, H. C., AND L. W. KAY. 1975. The Impacted Wisdom Tooth (2nd edition). Churchill Livingstone. London.

KREHL, W. A. 1976. The Role of Citrus in Health and Disease. Univ. Florida Press. Gainesville, Fl.

LEVENSON, S.M., E. SEIFTER, AND W. VAN WINKLE. 1977. Fundamentals of Wound Management in Surgery—Nutrition. Chirurgecom Publ. Inc. South Plainfield, N.J.

LEWIN, S. 1974. Evaluation of potential effects of high intake of ascorbic acid. Comp. Biochem. Phys. 47B:671-695.

________. 1976. Vitamin C: Its Molecular Biology and Medical Potential. Academic Press. New York.

LEWIS, W. H., AND M. LEWIS. 1977. Medical Botany: Plants Affecting Man's Health. Wiley. New York.

MOERTEL, C., T. FLEMING, E. CREAGAN, J. RUBIN, M. O'CONNELL, AND M. AMES. 1985. High-dose vitamin C versus placebo in the treatment of patients with advanced cancer who have had no prior chemotherapy. N. Engl. J. Med. 312:137-141.

MORTON, J. F. 1977. Major Medicinal Plants: Botany, Culture and Uses. Charles C. Thomas. Springfield, Illinois.

NIE, N. H., C. HULL, J. JENKINS, K. STEINBRENNER, AND D. BENT. 1975. Statistical Package of the Social Sciences. (2nd edition). McGraw-Hill. New York.

NEWBOLD, H. L. 1979. Vitamin C Against Cancer. Stein and Day. New York.

ORTIZ DE MONTELLANO, B. 1975. Empirical Aztec medicine. Science. 88:215-220.

Pauling, L. 1970. Vitamin C and the Common Cold. W. H. Freeman. San Francisco.

_________. 1974. Are recommended daily allowances for vitamin C adequate? Proc. Nat. Acad. Sci. 71:4442-4446.

PEARSON, D., AND S. SHAW. 1982. Life Extension. Warner. New York.

ROKOSOVA, B., AND M. CHVAPIL. 1974. Relationship between the dose of ascorbic acid and its structural analogs and proline hydroxylation in various biological systems. Conn. Tissue Res. 2:215-221.

SAUBERLICH, H. E. 1975. Vitamin C status: methods and findings. Ann. N. Y. Acad. Sci. 258:438-457.

SCHRAUZER, G. M., AND W. J. RHEAD. 1973. Ascorbic acid abuse: effects of long-term ingestion of excessive amounts on blood levels and urinary excretion. Int. J. Vit. Nutr. Res. 43:201-211.

SHARON, D. G., AND C. B. DONNAN. 1977. The magic cactus: ethnoarchaeological continuity in Peru. Archaeology. 30:374-381.

SHILOTRI, P. F., AND K. S. BHAT. 1978. Effect of magadoses of vitamin C on bactericidal activity of leucocytes. Am. J. Clin. Nutr. 30:1077-1081.

SIEGEL, V. B. 1977. Vitamin C and the immune response. Experientia. 33:393-395.

STONE, I. 1972. The Healing Factor: Vitamin C Against Disease. Grosset and Dunlap. New York.

THOMAS, W. R., AND P. G. HOLT. 1978. Vitamin C and immunity: an assessment of the evidence. Clin. Exper. Immun. 32:370-379.

Florida Sci. 51(1):41-48. 1988.
Accepted: August 6, 1987.

WATER QUALITY CHARACTERISTICS OF A SOUTHEAST FLORIDA SEWAGE TREATMENT AND BIOEFFECTS LABORATORY

Eugene F. Corcoran, Melvin S. Brown[1], and Samuel C. Snedaker

Rosenstiel School of Marine and Atmospheric Science, University of Miami,
4600 Rickenbacker Causeway, Miami, Florida 33149

Abstract: *A Sewage Treatment and Bioeffects Laboratory, located in southeast Florida, is described and water quality characteristics of the seawater-diluted wastewaters are compared with reported levels lethal to marine organisms. The laboratory processed incoming untreated (raw) wastewater and yielded six different effluents: primary settled, chemical flocculation, and activated sludge biological secondary settled, each chlorinated and non-chlorinated. Several water quality characteristics of the incoming untreated and biological secondary treated effluent were similar to those of a local sewage treatment plant using ocean outfall disposal. Effluent water quality was monitored for nutrients (NH_3, NO_2^-, NO_3^-, and PO_4^{3-}), toxic metals (Cd, Cr, Cu, Pb, and Zn) and synthetic organics (chlorinated pesticides, aldrin, DDE, DDD, DDT, dieldrin, heptachlor epoxide, endrin; polychlorinated biphenyls, Aroclor 1016, 1242, 1254, 1260; and phthalic acid esters, butylbenzyl, butylglycolbutyl, di-butyl, di-ethylhexyl, di-ethyl, di-isobutyl and di-methyl phthalate) using standard analytical techniques. Estimated ambient concentrations of nutrients, toxic metals and synthetic organic compounds, after a 30-fold dilution of primary settled wastewater with seawater, fell below reported levels lethal to marine organisms.*

The Southeast Florida Ocean Outfall Study (SEFOOS) was initiated to obtain information on the ecological effects of municipal wastewaters discharged to coastal marine waters following various degrees of treatment. Specifically, this information was to be used by the U.S. Environmental Protection Agency in establishing (or revising) effluent quality criteria (Federal Water Pollution Control Act Amendments of 1972, PL 82-500) under Sections 301 and 403, water quality criteria applicable to marine waters (Section 303), and best practicable treatment to be employed by 1983 (Sections 201 and 301) for municipal wastes discharged via ocean outfalls to waters of the territorial sea, the contiguous zone, or the open ocean. A study site in southeast Florida was chosen because of the extensive regional use of ocean outfall disposal. A major part of the program was the construction and testing of the Sewage Treatment and Bioeffects Laboratory (STABEL), an experimental facility to replicate the wastewater treatment process and the water quality of the surrounding marine environment. Here, we briefly describe the STABEL facility, and compare the water quality characteristics of the seawater-diluted wastewaters with reported levels of lethal toxicity.

Study Area, Facilities and Methods—The STABEL facility was situated on Virginia Key in the City of Miami, Dade County, Florida, on the University of Miami Rosenstiel School of Marine and Atmosphere Science (RSMAS) East Campus (25°44′06″N Lat., 80°09′36″W Long.). Untreated (raw) wastewater was supplied from the Metropolitan Dade County Virginia Key Sewage Treatment Plant (STP), the largest treatment facility in Florida ($4.5x10^8$ liters per day) using ocean outfall disposal. The untreated wastewater was taken from the entrance of a large grit chamber and supplied to STABEL via a force main and submersible grinder pumps. Any portion of the wastewater could be channeled through the plant or allowed to waste, thus being returned to the Virginia Key STP. The wastewater was processed using primary settling, chemical flocculation (using aluminum sulfate) of the primary settled wastewater, and activated sludge biological-secondary settling. Chlorination of the treated effluents was accomplished by an automated process which continuously monitored the residual chlorine content of the wastewater using amperometric methods. The residual chlorine sensing unit controlled the chlorine supply pump, intended to keep the residual chlorine at a constant, preselected concentration (1 mg/liter for the STABEL bioeffects experiments).

---

[1] Present address: Law Environmental, Inc., 112 Townpark Drive, Kennesaw, GA 30144-5599.

This process yielded six different effluents: primary settled, chemical flocculation, and activated-sludge biological-secondary settled, each chlorinated and non-chlorinated. The effluents were gravity fed to 95-liter holding tanks to represent the passage through and residence time in the ocean outfall pipeline, and then pumped by rate-controllable process pumps into a seawater pipeline with a known flow rate. Controlling the rate of flow of settled seawater and the pumping rates of the effluents allowed for an almost infinite range of dilution. The effluent-seawater mixture was passed through a mixing chamber and then into 380-liter, fiberglass bioeffects tanks containing the organisms for experimental exposure. The system diluted each of the six effluents to three different levels (30:1, 100:1, and 300:1), and replicated each of the dilutions in four of the bioeffects tanks. These dilutions were chosen to bracket the range of initial dilutions expected to be found near municipal ocean outfalls under conservative environmental conditions.

Of the eighty 380-liter bioeffects tanks, seventy-two were used for the seawater/effluent mixtures. Eight were control tanks receiving only settled seawater. In addition, eight 5,030-liter concrete stock tanks were available to hold and acclimate test organisms before use. Both the bioeffects and stock tanks contained a modified siphoning system which assured a continuous turnover and mixing of water at all levels of the tank. For additional information on the operating characteristics of the STABEL facility, see Young (1984).

Standard methods were used for the analysis of wastewater and seawater. Characterization of the wastewaters for operational constituents (residue, pH, turbidity, and biochemical oxygen demand [BOD]), nutrients, and metals followed those recommended by EPA (1976). The concentrations of nutrients in the incoming seawater were also determined using this methodology. Chlorinated pesticides, polychlorinated biphenyls (PCB) and phthalic acid esters (PAE) were analyzed using methods outlined by Thompson (1977). The compounds in these three groups, which were quantitatively analyzed, were: aldrin, DDE, DDD, DDT, dieldrin, heptachlor epoxide, endrin; Aroclor 1016, 1242, 1254, 1260; butylbenzyl, butylglycolbutyl, di-butyl, di-ethylhexyl, di-ethyl, di-isobutyl and di-methyl phthalate.

RESULTS AND DISCUSSION—A licensed operator with extensive experience in operating sewage treatment plants was retained to bring the STABEL facility into an operative mode (regarding primary and secondary treatment) similar to the Virginia Key STP. Frequent (often daily) contact was made with fellow operators at this plant to ascertain the current status of the wastewater influent being measured there, in an effort to “fine-tune” the STABEL facility. Average values for constituents measured in wastewater influent and treated effluent between March and October, 1980, are listed in Table 1. Comparison of these results for total non-filterable residue (total suspended solids) and biochemical oxygen demand (BOD) in both the influent and biological secondary effluent with corresponding values measured at the Virginia Key plant revealed no significant differences in these two important water quality constituents. Thus, it appears that during 1980 the STABEL facility was receiving a reasonably representative sample of raw wastewater, and that at least the experimental biological secondary treatment process was representative of the corresponding process at a full-size plant. On the average, the secondary treatment removed 70 percent of the total suspended

TABLE 1. Average (±1 std. error) values for water quality constitutes measured in STABEL wastewaters (March through October 1980). All values are for chlorinated wastewater unless indicated otherwise.

Constituent	Untreated		Primary		Chem. Floc.		Bio. Second.	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
mg/liter								
Total residue	1420 (8)[c]	100	1460 (10)	130	1540 (7)	100	1660 (9)	110
Total volatile residue	330 (8)	20	300 (10)	20	250 (7)	20	280 (9)	20
Total non-filterable residue[a]	160 (8)	30	160 (10)	60	76 (6)	14	49 (9)	14
Volatile non-filterable residue	53 (8)	22	55 (10)	15	26 (4)	5	19 (8)	6
Turbidity (NTU)	41 (10)	3	32 (11)	3	17 (8)	1	13 (11)	4
pH	7.7 (10)	0.2	7.6 (9)	0.2	7.5 (6)	0.2	7.2 (7)	0.2
BOD	130 (11)	8	80 (10)	6	31 (7)	4	16 (8)	5
Organic carbon	86 (8)	3	69 (8)	1	35 (7)	3	25 (7)	6
Ammonia-nitrogen[b]	16 (11)	1	16 (11)	1	14 (11)	2	9.4 (11)	1.8
Nitrite-nitrogen[b]	0.1 (9)	<0.1	0.2 (9)	0.1	0.2 (9)	0.1	2.0 (9)	1.5
Nitrate-nitrogen[b]	9.5 (9)	5.0	7.4 (8)	3.5	10 (8)	4	10 (9)	3
Ortho-phosphate[b]	1.2 (9)	0.3	1.2 (9)	0.3	0.4 (9)	0.1	1.0 (9)	0.3
µg/liter								
Cadmium	5.6 (7)	1.1	3.9 (7)	1.2	<2 (6)	—	<2 (7)	—
Chromium	32 (7)	6	28 (7)	8	12 (6)	3	14 (7)	5
Copper	29 (7)	4	38 (7)	8	7.8 (6)	3.7	7.6 (7)	4.1
Lead	20 (7)	2	19 (7)	4	10 (6)	2	5.0 (7)	1.1
Zinc	140 (7)	16	130 (7)	22	28 (6)	9	27 (7)	11
Chlorinated pesticides	0.6 (4)	0.2	0.7 (4)	0.5	2.7 (3)	1.5	1.1 (1)	—
Polychlorinated biphenyls	1.9 (4)	0.9	8.1 (4)	7.3	0.5 (3)	0.2	4.5 (1)	—
Phthalic acid esters	73 (5)	15	100 (6)	30	160 (3)	34	110 (3)	29

[a] Total suspended solids.

[b] Non-chlorinated wastewater.

[c] Sample size.

solids and 84 percent of the BOD measured in the influent to the STABEL facility.

Available data (or extrapolations from other studies) on water-quality characteristics of seawater from Biscayne Bay, used to dilute the various wastewaters for the flow-through toxicity tests, are presented in Table 2. The

TABLE 2. Average (or estimated) concentrations of nutrients, trace metals, and synthetic organics for Biscayne Bay seawater.

Nutrients, mg/liter		Trace Metals, µg/liter		Synthetic Organics, µg/liter	
NH_3-N:	0.04	Cd:	0.02	Chl. Pest.:	<0.01[b,c,d]
NO_2-N:	<0.01	Cr:	0.2[a]	PCB:	<0.01[b,d]
NO_3-N:	0.08	Cu:	0.4	PAE:	1[e]
PO_4-P:	<0.01	Pb:	0.4		
		Zn:	4		

[a] Nearshore southern California (Jan and Young, 1978).

[b] Nearshore southern California (Young, 1982).

[c] Nearshore Biscayne Bay (Seba, 1970).

[d] Galveston Bay, Texas (Murray *et al.*, 1981).

[e] Gulf of Mexico (Corcoran and Curry, 1978).

nutrient values are based on analysis of samples from the STABEL control tanks, and most of the trace metal data were obtained from MDC (1981).

To evaluate the toxicological implications of these data, we, as an example, have calculated the estimated concentrations of nutrients, trace metals, and synthetic organics in the exposure tanks following dilution of a given effluent by the control seawater. The calculations were made according to the formula (Eqn. 1) described in Tetra Tech (1982).

$$C_f = C_a + ((C_e - C_a)/D) \tag{1}$$

where C_a is the ambient (control seawater) concentration; C_e is the effluent concentration; D is the dilution factor; and C_f is the final (exposure) concentration. The results for primary effluent at a 30:1 dilution are listed in Table 3.

TABLE 3. Estimated average concentrations of nutrients, trace metals, and synthetic organics in 30:1 seawater dilutions of STABEL primary effluent.

Nutrients, mg/liter		Trace Metals, µg/liter		Synthetic Organics, µg/liter	
NH_3-N:	0.57	Cd:	0.15	Chl. Pest.:	0.03
NO_2-N:	<0.02	Cr:	1.1	PCB:	0.28
NO_3-N:	0.32	Cu:	1.7	PAE:	4.3
PO_4-P:	0.04	Pb:	1.0		
		Zn:	8.2		

In general, these concentrations represented the highest levels in the exposure tanks, as additional treatment and additional dilution water resulted in lower concentrations in many of the exposures. The possible relationship of the highest concentrations to toxicity is discussed in the following three sections.

Nutrients—Of the nutrients studied, ammonia is the only one believed to be toxic at levels approaching those reported in the vicinity of marine discharges. However, at the temperature (approx. 20°C) and pH (approx. 8) of the ambient seawater, approximately 96 percent of the ammonia occurs as the ammonium ion (Emerson *et al.*, 1975), which generally is lethal to aquatic organisms (as ammonium hydroxide) in the 10-100 mg/liter range. For un-ionized ammonia, the corresponding range is 1-10 mg/liter (Lewis and Tatken, 1980). Thus, the estimated average exposure level for total ammonia (ammonium plus un-ionized ammonia) shown in Table 3 was one to two orders of magnitude below that reported to be lethal to aquatic organisms.

Trace Metals—For four of the five trace metals included in this study, the Environmental Protection Agency (1985a-d) has revised Ambient Water Quality Criteria for saltwater aquatic life (only preliminary revised values are available for zinc). These criteria usually include two values, one based on a four-day averaging period and the other based on a one-hour averaging

TABLE 4. Comparison of EPA revised Ambient Water Quality Criteria (1984) with average trace metal concentrations observed in 30:1 seawater dilutions of STABEL primary effluent.

Trace Metals	STABEL (Primary, 30:1) μg/liter	Water Quality Criteria (4-day Avg.) μg/liter	(1-hr Avg.)
Cd	0.15	9.3	43
Cr[a]	1.1	50	1100
Cu	1.7	—[b]	2.9
Pb	1.0	5.6	140
Zn[c]	8.2	86	95

[a] Hexavalent chromium. No values given for trivalent chromium (although an EC_{50} value of 10,300 μg/liter for eastern oyster embryos was cited).

[b] No value given.

[c] Preliminary values, subject to change (T. Purcell, U.S. EPA, pers. comm.).

period; neither of the values is to be exceeded more than once every three years, on the average. For chromium, the criteria applies only to the most toxic hexavalent (VI) oxidation state. The estimated worst case exposure levels for the STABEL facility are compared to these EPA criteria in Table 4.

This comparison shows that, with the exception of copper, the exposure levels of metals were at least one order of magnitude below the estimated safe upper limit values. However, in high-organic waters (such as sewage and nearshore seawater), it has been shown that only a small fraction of the measurable copper is toxic (Sunda and Guillard, 1976). Thus, it seems unlikely that the levels of the target metals in the STABEL exposures were high enough to cause measurable toxicity.

Synthetic Organics—The only chlorinated pesticides identified in the STABEL wastewaters were aldrin, endrin, heptachlor epoxide, and DDE. Concentrations of these compounds (which were measurable in only about 15 percent of the samples) typically ranged between 0.1 and 0.6 μg/liter; after the minimum (30:1) dilution, none of these compounds would have exceeded the minimum levels reported in EPA's Ambient Water Quality Criteria documents, to be lethal to marine organisms. This was also the case for the dominant PCBs (most closely resembling Aroclor 1242 and 1254) and for the measurable phthalic acid esters (di-butyl; di-isobutyl; butylglycolbutyl; butylbenzyl; and di-ethylhexyl phthalates), whose worst-case exposure levels are shown in Table 3.

CONCLUSIONS—This experimental flow-through facility appears to have provided effluents from the primary, and biological secondary wastewater treatment processes, that are reasonably representative of those produced by Metropolitan Dade County's Virginia Key Sewage Treatment Plant. Any desired dilution of these effluents (chlorinated or non-chlorinated) by settled seawater could be obtained to simulate receiving-water conditions following marine discharge. Estimated ambient concentrations of nutrients, toxic metals, and synthetic organics following a 30-fold dilution of primary-treated wastewater (the worst-case scenario) generally fall far below the levels lethal to marine organisms.

ACKNOWLEDGMENTS—This study was conducted in collaboration with University of Miami professor Dr. Lanny Udey (Jackson Memorial Medical Center, Department of Microbiology and Immunology), and the Rosenstiel School's Analytical Laboratory. The assistance of Mr. Jack Baird (Water and Wastewater Systems, Inc., Miami, Florida) and the Metro-Dade County Water and Sewer Authority is deeply appreciated. We thank the study's Project Officers Mr. Robert Brice and Ms. Faith Cole for their guidance and suggestions. We thank especially Drs. David Young and Donald J. Baumgartner, U.S. Environmental Protection Agency, for their assistance with the manuscript. This study was conducted under EPA Grants R-804749 and R-806307 to the University of Miami (Dr. S.C. Snedaker, Principal Investigator), and Contract No. 68-03-1706 with Dames & Moore (Dr. David R. Young, Principal Investigator).

LITERATURE CITED

CORCORAN, E. F., AND R. W. CURRY. 1978. Phthalic acid esters in the marine environment. Rev. Biol. Trop. 26(Supl. 1):125-133.

EMERSON K., R. C. RUSSO, R. E. LUND, AND R. V. THURSTON. 1975. Aqueous ammonia equilibrium calculations: effect of pH and temperature. J. Fish. Res. Board Can. 32:2379-2383.

ENVIRONMENTAL PROTECTION AGENCY. 1976. Methods for chemical analysis of water and wastes. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-625/6-74-003a.

_________. 1985a. Ambient Water Quality Criteria for Cadmium—1984. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. 20406. EPA 440/5-84-032.

_________. 1985b. Ambient Water Quality Criteria for Chromium—1984. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. 20406. EPA 440/5-84-029.

_________. 1985c. Ambient Water Quality Criteria for Copper—1984. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. 20406. EPA 440/5-84-031.

_________. 1985d. Ambient Water Quality Criteria for Lead—1984. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. 20406. EPA 440/5-84-027.

JAN, T. K., AND D. R. YOUNG. 1978. Chromium speciation in municipal wastewaters and seawater. J. Water Poll. Control Fed. 50(10):2327-2336.

LEWIS, R. J. SR., AND R. L. TATKEN. 1980. Registry of toxic effects of chemical substances, 1979 ed., Vol. 1. U.S. D.H.H.S., Cincinnati, Ohio.

METROPOLITAN DADE COUNTY. 1981. Biscayne Bay Water Quality: Reporting Period March 1980-February 1981. Metropolitan Dade County, Dept. Environ. Resources Manag., 111 NW First St., Miami, Florida 33128 (photocopy).

MURRAY, H. E., L. E. RAY, AND C. S. GIAM. 1981. Phthalic acid esters, total DDTs, and polychlorinated biphenyls in marine samples from Galveston Bay, Texas. Bull. Environm. Contam. Toxicol. 26:769-744.

SEBA, D. A. 1970. Pesticide bioassay: physical/chemical and biological effects of dieldrin on teleosts. Ph.D. Thesis, Univ. Miami, Miami, Florida.

SUNDA, W., AND R. L. GUILLARD. 1976. The relationship between cupric iron activity and the toxicity of copper to phytoplankton. J. Mar. Res. 34:511-529.

TETRA TECH. 1982. Revised Section 301(h) Technical Support Document. Tetra Tech, Inc., Bellevue, WA. Submited to U.S. E.P.A., Washington, D.C. EPA-430/9-82-11 (NTIS No. PB83-15387).

THOMPSON, J. F. 1977. Manual of analytical methods for the analysis of pesticides residues in human and environmental samples. U.S. E.P.A., Environmental Toxicology Division, Research Triangle Park, North Carolina.

YOUNG, D. R. 1982. Chlorinated hydrocarbon contaminants in the southern California and New York Bights. Pp. 263-276. *In:* MAYER, G. F. (ed.). Ecological stress and the New York Bight: science and management. Estuarine Research Foundation, Columbia, South Carolina.

________. 1984. Summary of effects of partially-treated sewage on nearshore environments of southeastern Florida. Final report to U.S. E.P.A. from Dames and Moore, Los Angeles, California. EPA/600/3-85/020 (NTIS No. PB85-185825/GAR).

Florida Sci. 51(1):49-55. 1988.
Accepted: September 1, 1987.

REVIEW

William Seaman, Jr., Editor, *Florida Aquatic Habitat and Fishery Resources*, Florida Chapter American Fisheries Society, 207 West Carrol Street, Kissimmee, FL 32741, 1985. Soft Cover. Pp. xiv + 543. Price: $15.00.

This monograph is an interesting outgrowth of a symposium that was held in 1983 to review the status of significant Florida freshwater and marine habitats and fishery resources. It is the product of careful writing by 44 authors, 19 technical reviewers, and a very careful editor. The papers run an interesting range from an introduction that should appeal to the educated layperson to more technical topics that are clearly written and should be appreciated by a range of scientists. Following a useful introduction, and a well written chapter on the economics of fisheries and habitat, six habitats are covered viz., lakes, rivers, salt marshes, mangroves, estuaries, and ocean. The organization is impressive, and the contributors (and technical reviewers) are to be commended for the clarity of the writing and the consistency of the presentation of the text, figures and tables. Some 1,000 technical articles are cited, with consistent, thorough citations. This contribution is recommended to all readers who are interested in the environment of Florida. As nearly 1,000 persons a day come to Florida with the intention of staying for some appreciable period of time, they impact the environment that attracted them. This book reminds us that high-quality fishing-related environments are important to all of us, and it will help serve as a resource book. The editor, contributors, technical reviewers, and sponsors are to be commended for their contribution, which is valuable and a bargain.—Dean F. Martin, University of South Florida, Tampa.

THE ETHNOGRAPHY OF AN EXTENDED CARE TREATMENT RESIDENCE FOR HOMELESS MEN WHO ARE CHRONIC ALCOHOLICS

Lois Bright Randolph

Department of Anthropology, University of South Florida, Tampa, FL 33620

Abstract: *This ethnographic study focuses upon the interactions of residents and staff at an alcoholism treatment facility for chronic public inebriates. Through direct observation, interviewing, and perusal of statistical material in agency files, both resident and staff cultures were examined. Fundamental findings suggest that residents and staff are two separate subcultures interacting in a specific treatment milieu. Tentative conclusions suggest that an ethnography using the methodology of participant observation can lead to an understanding of the complex cultural patterns and processes involved in the treatment of alcoholism at a domiciliary for homeless men.*

Since the alcoholic does not exist in a psychological, social and cultural vacuum, any analysis of alcoholism treatment must attend to the context in which the treatment takes place: namely the setting, the staff, the residents and the processes of interaction (Strugg et al., 1986). This ethnographic study focuses on the interactions of residents and staff at an extended care treatment residence, or domiciliary, for chronic public inebriates in the State of Florida. The treatment setting, and the staff and resident subcultures are described. The study examines how these two separate subcultures interact in this specific treatment milieu.

Methods—The methodology employed in the study was participant observation. For seven months the researcher was involved in the activities of the treatment culture. These activities included: mealtimes, recreation, peer group counseling, relaxation therapy, shopping trips, group therapy, development of treatment plans, Alcoholics Anonymous meetings, individual counseling, and attendance at community and staff meetings. Intakes and psychosocial evaluations were administered on new residents. Information gleaned from these activities, along with the data collected from existing records of the agency, provided statistical compilations on the demographic characteristics of 51 men. This statistical information, along with repeated interviews utilizing constant cross-checking between private individual and group statements of both residents and staff, and hours of direct observation provided reliable data.

Setting—The extended care residence is located in a combination residential/industrial area close to public transportation. The property encompasses between two and three acres. The main house is in the middle of the compound; 8 apartments capable of housing 50 men form a line down each side of the property. They are separated from the main building by gardens which the residents maintain themselves. Inside the main building are offices, a dining room where the residents dine cafeteria-style, a kitchen, an all-purpose room, and a combination television/reading room.

STAFF—The daytime treatment staff at the domiciliary includes a supervisor and two counselors. The supervisor, G., and one counselor, J., have B.S. degrees in psychology; both are women. The other counselor, L., a man, has a high school diploma and over eight years of experience counseling alcoholics. G. is in her late thirties and J. is in her early twenties; L. is in his late sixties. All of the staff are recovering alcoholics; J. is also a recovering cocaine addict.

Each member of the staff views treatment procedures in a surprisingly similar way. Each believes that the treatment program should be centered around the Alcoholics Anonymous model of therapy. This model fully accepts the disease concept of alcoholism and maintains that it is a physical and mental affliction (Jellinek, 1960). Alcoholics Anonymous (AA) requires total abstinence on the part of the alcoholic who must admit both privately and publicly that he/she has no control over the ingestion of alcohol. This inability to control alcohol consumption requires that the alcoholic turn him/herself over to a higher power. AA acts as a support group for the alcoholic who is trying to maintain sobriety. Members are encouraged to verbalize their feelings in front of other members. No alcoholic is ever "cured"; they are always "recovering." This ideology is clearly enunciated in the book *Twelve Steps and Twelve Traditions* (Alcoholics Anonymous, 1984). This book, along with *Alcoholics Anonymous* (Alcoholics Anonymous, 1976), is considered the basic text of the AA program. It is required reading for all members. Men at the domiciliary are given copies of these books when they become residents.

Staff are in complete agreement that in order to recover, residents must become members of AA and live by the AA philosophy. Maintaining sobriety comes first, and everything else such as home, vocation, family and social relations are secondary until sobriety is assured. Along with maintaining sobriety, staff agree that the residents must be self-motivated and dependence must be discouraged lest they return to drink or become institutionalized. This dictum translates into an expectation on the part of staff that the men will do most things for themselves with minimal guidance and direction from staff (Tremper, 1986). Also, staff expect the men to abandon street values and replace them with the new values and social skills necessary for rehabilitation. Staff also expect clients to be amiable and willing to become fully involved in the community. Disruptive or deviant behavior of any kind is not tolerated. Upon arrival at the domiciliary, residents are given a list of rules which they must follow.

Staff seldom socialize with the residents. They do not take their meals with residents nor do they participate in recreational activities together. A certain distance is always maintained.

The older member of staff, L., objects to treating residents who are polyaddicted, but the younger counselor, J., believes it is necessary because "you cannot separate the two." L. uses rational emotive therapy (Ellis and Grieger, 1977), exhorting clients to "use logic to turn negative emotions to positive ones." His approach is didactic. J. uses psychodrama and discussion; her approach is more egalitarian.

G., the supervisor, works very skillfully with the residents. She is confrontive, but she is also gentle and understanding. She *insists* upon a complete cessation of drinking and doesn't hesitate to search apartments for weapons, drugs, and alcohol. She is not timid; if she finds anyone not abiding by the rules, she dismisses them from the facility. She is always most concerned with the overall good of the community.

G. and L. came to the domiciliary together to work as a team. They decided to change the treatment philosophy from one with an emphasis on extended care to one with emphasis on rehabilitation. G. stated that she was "anxious to change the revolving door image of the domiciliary and make it known in the community that it is possible to rehabilitate the skid row drunk."

RESIDENTS—Demographic data was collected on 51 case studies selected at random from the client files at the domiciliary. The information was based on self-reports of alcoholic subjects. Of the 51 subjects, all were male and the average age was 47 years old. There were 15 subjects under the age of 40 and 9 subjects over the age of 60. The youngest man was 30 and the oldest man was 73. All were homeless.

Though many were once professionals or skilled workers, the majority now referred to themselves as "unskilled." Average grade completed in school was 11.8 and the median grade was 12. Four men did not complete grade school; 16 men attended college and two received college degrees. Though 44 of the men (86%) had once been married, only one man was presently married, and he was 73 years old.

All 51 men had completed alcoholism treatment programs "too numerous to mention." Twenty-six (50%) of the men had a history of familial alcoholism, and 41 (80%) began drinking before or at the age of 18. Thirteen (39%) were poly-addicted to several drugs. Of these men, 80% were under the age of 40 and 60% had been in Vietnam. In fact, 75% of the men at the "dom" under the age of 40 were Vietnam War veterans. Forty-four men had been arrested 1,416 times. Seven had never been arrested. Almost all of the men had some acquaintance with AA, but only six (12%) said that it had kept them sober for any significant length of time.

The demographic data suggests a dichotomy which is present among residents. Thirty-six (71%) are traditional chronic public inebriates. These men are usually in their late forties or fifties, and onset of the disease of alcoholism has slowly progressed over a period of 20 years or more. Their drug of choice is alcohol. However, 15 (29%) of the residents were younger men under the age of 40. Early deterioration of their condition could be attributed to the incidence of poly-drug use among this population. The younger men are more aggressive and highly unpredictable. The majority have served in Vietnam and many could be dually diagnosed, afflicted with both alcoholism and mental illness. The older men are more passive, and they seem to have had similar life experiences. Each group seems, at times, to resent the presence of the other; in spite of their differences, the men all recognize that they have one common problem—alcoholism. They blame themselves for their inability to stay sober. This feeling of negativity pervades the community and works at cross-purposes with the attempts of staff to instill positive attitudes. The central tenet of the staff's AA approach to therapy is that the alcoholic must change negative thought patterns to positive ones. This seems difficult for the men to do, and they seem to reinforce one another's negativity.

This negative attitude prevents residents from becoming involved with one another and accepting the day-to-day responsibilities in the community which staff deems to be so important for their recovery. Staff encourage men to share problems and cultivate close relationships with one another, but this seldom happens. Their former skid row environment, where men quickly move on from place to place or are arbitrarily removed by death or the police, militates against cultivation of friendships (Cook, 1975).

Discussion—While staff are mainly interested in helping the men maintain sobriety, the men are mainly interested in shelter, food, some decent clothes to wear, having medical problems attended to, and the possibility of finding gainful employment. Staff thinks about the future; the men are accustomed to doing what they must to survive from day to day (Wiseman, 1970; Siegal, 1978). Ultimately, staff and residents have different priorities. Staff sees sobriety as the most important consideration. After a man demonstrates that he can remain sober, then all life's problems will fall into place. Staff postulates that drinking has caused the resident to have problems with family, work, finances, and social relations generally. The men, though they pay lip service to the staff's interpretation of their lives, see things differently. If they can restore their social margin, if they can reunite with their families, if they can find gainful employment, then they will be able to stay sober. The ideological sequences of staff and residents are simply reversed, and this often causes a communications gap between the two groups.

As was stated previously, staff at the domiciliary have two things in common: 1) They are all recovering alcoholics; 2) they are all ardent proselytizers of the Alcoholics Anonymous treatment philosophy. As a treatment strategy at the domiciliary, this commonality of approach is both advantageous and maladaptive. On the positive side, residents and staff can identify with one another since they share the common problem of alcoholism, and this facilitates empathy which is so essential in the counselor/client relationship. On the negative side, alcoholics can be very hard on one another. It goes without saying that "conning" and "denial" are a central part of the alcoholic behavioral repertoire. However, *just because* the pattern is so familiar, certain subtleties and behavioral cues can be misread; certain actions can be completely missed or misinterpreted. Recovering alcoholics have to work doubly hard to keep from becoming cynical about alcoholic behavior patterns. To be overly suspicious of events, or to be too pessimistic about possible changes in behavior, can be as harmful as the melioristic, naive approach of the uninitiated. The men often remark that staff seem to "forget where they came from."

AA, while it appears to be a highly effective treatment modality for large numbers of alcoholics, may not work for everyone, and especially not for everyone in this skid row population (Trice and Roman, 1970; and Tournier, 1979; Heath, 1981). Most men report that they do not do well at AA meetings. They feel overwhelmed and often frustrated by the whole experience. They do not dare share this observation with staff who believe that if an alcoholic cannot fit himself/herself into the AA model he/she must surely be given up for lost.

Staff's insistence that residents be self-motivated and independent often frustrates residents. There is a fine line between dependency and discouragement. Residents need to be encouraged to get their teeth fixed, have possibly dangerous and uncomfortable tumors removed, or get a physical checkup if heart rhythm is irregular. They probably won't be "motivated" to do these things on their own because they are so used to being ignored or turned away (Otto and Orford, 1978). Residents often feel that they are bothering staff when they need assistance, because staff always seem to be so busy with paper work and act chagrined that the resident is making a demand on their time.

A frequent complaint of residents is that staff do not take enough interest in their problems generally and especially in the problem of finding gainful employment. Staff believe that residents should not be concerned with employment until they have maintained sobriety for a significant period of time. This is always a source of contention between residents and staff.

SUMMARY—It is an inescapable fact that the skid-row population has changed (Levinson, 1974; Siegal, et al. 1975; Whitley et al., 1985). The skid-row culture is no longer as homogeneous as it was once thought to be. Now homeless men are as apt to be in their thirties as in their late forties or fifties; often they are poly-addicted and dually diagnosed. Substance abuse counselors must be able to relate to individual clients, regardless of what their particular age or particular drug habit might be.

An anthropological perspective on the treatment of alcoholism among homeless men requires the participant observer to become familiar not only with the point of view of the alcoholic in treatment, but also with the attitudes, beliefs and values of the treatment staff. An ethnography using the methodology of participant observation can lead to an understanding of the complex cultural patterns and processes involved in the treatment of alcoholism at a domiciliary for homeless men. The relevance of this information should be obvious. As Spradley (1970:7) states:

> "If we are successful in discovering the culture of urban nomads, the description should provide an outsider with information and rules to

> enable him to operate in a manner acceptable to these men, to see the world as they see it, to adapt to the world as they do."

Staff are proponents of an anti-drinking subculture based on the precepts of Alcoholics Anonymous (Rubington, 1977); the residents are members of a skid row subculture where the central identifying feature is the drinking of alcoholic beverages (Spradley, 1970). The anthropologist in the treatment setting may act as a bridge between staff and residents in order to help them more clearly communicate with one another (Heath, Waddell, and Topper, 1981).

LITERATURE CITED

ALCOHOLICS ANONYMOUS. 1976. Alcoholics Anonymous. Alcoholics Anonymous World Services, Inc., New York.

________. 1984. Twelve Steps and Twelve Traditions. Alcoholics Anonymous World Services, Inc., New York.

COOK, T. 1975. Vagrant Alcoholics. Routledge and Kegan Paul, London, England.

ELLIS A., AND R. GRIEGER (eds.). 1977. Handbook of Rational-Emotive Therapy. Springer, New York, New York.

HEATH, D. 1981. Determining the sociocultural context of alcohol use in cultural factors. Pp. 9-18. *In:* HEATH, D., J. WADDELL, AND M. TOPPER (eds.). Alcohol Research and Treatment of Drinking Problems. Supplement No. 9, J. Stud. Alcohol.

________, J. WADDELL, AND M. TOPPER (eds.). 1981. Cultural factors in alcohol research and treatment of drinking problems. Supplement No. 9, J. Stud. Alcohol. 247-256.

JELLINEK, E. 1960. The Disease Concept of Alcoholism. Hillhouse Press, Highland Park, New Jersey.

LEVINSON, D. 1974. Skid Row in transition. Urban Anthropology 3:79-93.

OTTO, S., AND J. ORFERD. 1978. Not Quite Like Home: Small Hostels for Alcoholics and Others. John Wiley and Sons, New York, New York.

RUBINGTON, E. 1977. The role of the halfway house in the rehabilitation of alcoholics. Pp. 351-383. *In:* KISSIN, B., AND H. BEGLEITER (eds.). Treatment and Rehabilitation of the Chronic Alcoholic. Plenum Press, New York, New York.

SIEGAL, H., D. PETERSEN, AND C. CHAMBERS. 1975. The emerging skid row: Ethnographic and social notes on a changing scene, J. Drug Issues 5:160-166.

________. 1978. Outposts of the Forgotten: Socially Terminal People in Slum Hotels and Single Room Occupancy Tenements. Transaction Books, New Jersey.

SPRADLEY, J. 1970. You Owe Yourself A Drunk: An Ethnography of Urban Nomads. Little Brown, Boston, Massachusetts.

STRUG, D., S. PRIYADARSINI, AND M. HYMAN (eds.). 1986. Alcohol Interventions: Historical and Sociocultural Approaches. The Haworth Press, New York, New York.

TOURNIER, R. 1979. Alcoholics Anonymous as treatment and as ideology. J. Stud. Alcohol 40:230-9.

TREMPER, M. 1986. A case of ideology in alcoholism treatment. Pp. 143-160. *In:* STRUG, D., et al. (eds.). Alcohol Interventions: Historical and Sociocultural Approaches. The Haworth Press, New York, New York.

TRICE, H., AND P. ROMAN. 1970. Sociophsychological predictors of affiliation with Alcoholics Anonymous: A longitudinal study of "treatment success." Soc. Psychiatry 5:51-59.

WHITLEY, M. P., O. H. OSBORNE, M. A. GODFREY, AND K. JOHNSTON, 1985. A point prevalance study of alcoholism and mental illness among downtown migrants. Soc. Sci. Med. 20(6):579-583.

WISEMAN, J. 1970. Stations of the Lost. Prentice-Hall, Inc., Englewood, New Jersey.

Florida Sci. 51(1):56-61. 1988.
Accepted: September 1, 1987.

REVIEW

Robin B. Huck, *Systematics and Evolution of Dicerandra (Labiatae).* Phanerogamarum Monographiae 19. Berlin and Stuttgart: J. Cramer. 1987. 343 pp.; 70 + 13 (appendix) figs.; 22 + 88 (appendix) tabs. Price not quoted.

THE labiate genus *Dicerandra* consists of seven species endemic to southeastern United States. The genus is of special interest to Florida botanists because four of the five species found in Florida are endemic to the state, and of these, three are restricted to only one or two counties. The narrow Florida endemics occur in the endangered sand pine scrub community in peninsular Florida.

The publication, based on a doctoral dissertation submitted to the University of North Carolina, is comprehensive. Included are sections on morphology, nomenclatural history, ecology, pollination biology, and reproductive biology. Only chemical data are lacking. The section on reproductive biology is especially interesting because many experimental crosses were performed.

Unfortunately the book suffers from poor organization. For example, when using the chapter on systematics (Chapter 9), the reader is required to refer to Chapter 2 for discussion of nomenclature and typification and to Chapter 5 for information on ecology. Even within these chapters, the information is difficult to find. The specimen citations are placed at the end of the systematic treatment rather than with each species as is traditionally done. The photographs of type specimens are of poor quality, appearing slightly out of focus with the labels difficult or impossible to read. Pages containing figures are unnumbered, sometimes making them difficult to find when using the table of contents. Figure numbers on maps are also missing. The author is often verbose, taking four paragraphs to say what could be better stated in one. The 122 pages of appendix consist essentially of raw data, primarily that on the hybridization studies. This could better be handled with a series of summary tables.

On the technical side, the author does not appear to have a clear concept of typification as she frequently "designates the holotype" of previous published species rather than identifying the holotype as is really the situation. In the case of *Ceranthera linearifolia* Elliott, the author "designates a holotype" at Kew when in fact the Kew specimen is merely the leading candidate for lecto- or neotypification. She also identifies the Elliott specimen of *C. linearifolia* from the Schweintz herbarium as an isotype, after making a strong case that it is only a topotype.

The book contains vast amounts of new data, especially on reproductive biology which makes it extremely valuable. But organization along more traditional lines and better editing would have improved it.—Richard P. Wunderlin, Department of Biology, University of South Florida, Tampa, FL 33620.

REVIEW

Michael J. Duever, J. E. Carlson, J. F. Meeder, L. C. Duever, L. H. Gunderson, L. A. Riopelle, T. R. Alexander, R. L. Myers, and D. P. Spangler, *The Big Cypress National Preserve*, National Audubon Society, New York City, 1986. Pp. xvii + 455. Price: $30.00.

This volume is a re-issuance of the 1979 report by the Center for Wetlands and the National Audubon Society. The 1986 version has been improved in terms of visual appeal and editorial accuracy. The body of information included here remains essentially the same, that is to say, the new volume collects into one document an impressive amount of data which is significant for several reasons. First, an area of immense importance to the state of Florida is described in detail. Second, while the book includes a good deal of information which is of absorbing interest to ecologists, it also addresses two factors not often given in-depth treatment in a descriptive volume: fire and land use. The solid treatment of these two topics greatly expands the appeal of the book to include land managers, planners, engineers, and the informed general public. Particularly interesting is the discussion contained in Chapter 7 of fire's effects on the habitats in south Florida—a subject which the authors rightly suggest needs further, long-term study in a practical context. The impacts of roadways and bridges, discussed in Chapter 8, will also be very useful to traffic planners who are responsible for the selection of alignments for new facilities crossing relatively undisturbed lands.

Overall, it is the fact that the data and analysis contained in the book have immediate application in the planning and design of the infrastructure which will come into being to accommodate the population growth of Florida which gives the book its greatest value. Therefore, as a resource in environmental impact analysis, the book will continue to find an eager audience. However, the agencies managing large tracts of land held in public ownership should note that, as a compilation of hydro-biological knowledge about an important ecosystem, the book serves as an excellent model for additional volumes on other areas of our state, eg. the Green Swamp, several State and National parks/recreation areas, etc. Support for the production of similar books would be invaluable in developing a meaningful data base on some of these large, public tracts.—Patricia M. Dooris, HDR Engineers, Tampa.

INSTRUCTIONS TO AUTHORS

Individuals who publish in the *Florida Scientist* must be active members in the Florida Academy of Sciences.

Submit a typewritten original and two copies of the text, illustrations, and tables. All typewritten material—including the abstract, literature citations, footnotes, tables, and figure legends—shall be double-spaced. Use one side of 8½ × 11 inch (21½ cm *X* 28 cm) good quality bond paper for the original; the copy may be xeroxed. Margins should be at least 3 cm all around. Number the pages through the Literature Cited section. Avoid footnotes and do not use mimeo, slick, erasable, or ruled paper. Use metric units for all measurements. Assistance with production costs will be negotiated directly with authors of papers which exceed 10 printed pages. *Excess over 10 pages by an author in a single volume will result in charges for additional pages.*

ADDRESS follows the author's name.

ABSTRACT—All manuscripts shall have a short, concise, single-paragraphed abstract. The abstract follows immediately the author's address.

ACKNOWLEDGMENTS are given in the body of the text preceding immediately the Literature Cited section.

LITERATURE CITED section follows the text. Double-space every line and follow the format in the current issue.

MANUSCRIPT of 5 or less, double-spaced typewritten pages should conform to the short article protocol. See recent issue for proper format of both long and short articles.

TABLES shall be typed on separate sheets of paper, double-spaced throughout. Each table shall contain a short heading. Do not use vertical rulings. Maximum character width, including spaces, of tables is 98.0. This includes a minimum space of 5 characters between columns. Tables are charged to authors at $30.00 per page or fraction.

ILLUSTRATIONS—All drawings shall be done in good quality India ink, on good board or drafting paper. Letter by using a lettering guide or equivalent. Typewritten letters on illustrations are unacceptable. Drawings and photographs should be large enough to allow 1/3 to 1/2 reduction in size. Photographs shall be glossy prints of good contrast. Whenever possible, mount photographs in lots size.

The author's name and figure number should be penciled lightly on the back of each figure. Figure legends must be listed on a separate page and *not* on the drawing or photograph. The legend must be double-spaced. Illustrations are charged to authors at $25.00 per page or fraction.

PROOF must be returned promptly. Notification of address change and proofreading are the author's responsibility. Alterations after the type has been set will be charged to the author.

REPRINTS may be ordered from the printer on forms provided when the corrected proofs are returned to the Editor.

FLORIDA ACADEMY OF SCIENCES

INSTITUTIONAL MEMBERS FOR 1986-87

Archbold Biological Station
Florida International University
Florida Institute of Technology
Newfound Harbor Marine Institute
University of Central Florida
Florida Department of Natural Resources
University of South Florida

Membership applications, subscriptions, renewals, changes of address, and orders for back numbers should be addressed to the Executive Secretary, Florida Academy of Sciences, 810 East Rollins Street, Orlando, Florida 32803.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01354 1958

PUBLICATIONS FOR SALE

by the *Florida Academy of Sciences*

Complete sets. Broken sets. Individual numbers. Immediate delivery. A few numbers reprinted by photo-offset. All prices strictly net. No discounts. Prices quoted include domestic postage.

PROCEEDINGS OF THE FLORIDA ACADEMY OF SCIENCES (1936-1944)
  Volumes 1-7 — $10.00 per volume; single numbers $3.50
QUARTERLY JOURNAL OF THE FLORIDA ACADEMY OF SCIENCES (1945-1972)
  Volumes 8-35 — $10.00 per volume; single numbers $3.50
FLORIDA SCIENTIST (1973-1975)
  Volumes 36-38 — $10.00 per volume; single issues $3.50 except for symposium numbers priced separately.
  Volumes 39 onward — $13.00 per volume; single numbers $4.25 except for symposium numbers priced separately.
  Volumes 48 onward — $20.00/volume; single numbers $5.00 except for symposium numbers priced separately.
Florida's Estuaries — Management or Mismanagement? — Academy Symposium
  FLORIDA SCIENTIST 37(4) — $5.00
Land Spreading of Secondary Effluent — Academy Symposium
  FLORIDA SCIENTIST 38(4) — $5.00
Solar Energy — Academy Symposium
  FLORIDA SCIENTIST 39(3) — $5.00 (includes do-it-yourself instructions)
Anthropology — Academy Symposium
  FLORIDA SCIENTIST 43(3) — $7.50
Shark Biology — Academy Symposium
  FLORIDA SCIENTIST 45(1) — $8.00
Future of the Indian River System — Academy Symposium
  FLORIDA SCIENTIST 46(3/4) — $15.00

Individual orders should be sent with payment. A statement will be sent in response to a bona fide purchase order over $10.00 from a recognized institution. Address all orders to:

The Florida Academy of Sciences, Inc.
c/o The Orlando Science Center
810 East Rollins Street
Orlando, Florida 32803
Phone: (305) 896-7151
